HERPETOLOGICA

Volume 16 December 30, 1960

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Established 1936. Organ of the HERPETOLOGISTS LEAGUE,
A.A.A.S. Affiliate. Society of Systematic Zoology, Affiliate.

President, Dr. Hobart M. Smith. Vice-President, Dr. Angus M. Woodbury

Editor, Dr. Wilmer W. Tanner. Published Quarterly (Spring, Summer, Autumn, Winter) at Brigham Young University, Provo, Utah. Application to mail at Second Class Postage rates pending at Provo, Utah.

Officers elected and policies determined by vote of members. $4.00 per volume (Yr.)

Vol. 16 March 31, 1960 No. 1

The Discovery of *Phyllodactylus tuberculosus* (Reptilia : Sauria) in Central America, The Resurrection of *P. xanti*, and Description of A New Gecko from British Honduras

By JAMES R. DIXON

In 1835 Wiegmann described *Phyllodactylus tuberculosus* from a series of lizards presumably collected by Dr. Meyen in South America. The locality from which the new species came was labeled "Californien." This may also imply the Territory of California or Baja California. However, it has been shown by Smith (1935) that the "Reise" passed no closer to California than Peru, Galapagos Archipelago, and Honolulu. Smith assumed that the name "Californien" applied to a small village somewhere in western South America, but Mosauer (1936) thought Smith to be in error and suggested that the specimens could have been purchased, preserved in a bottle, from a sailor. Taylor (1942) suggests that both assumptions should be given equal credit, but the type locality will be in question until the type of *tuberculosus* is rediscovered and compared with all known species of *Phyllodactylus* having enlarged dorsal tubercles.

I would here inject a third possibility: The name "Californien" is not necessarily a territory as implied by Mosauer (*op. cit.*) but may also apply to a village, town, or physiographic region. The deserts of western Central and South America are similar to those in California and Mexico. Furthermore Latin American towns and provinces are known to change their names frequently. However, Mosauer stated that Smith did not show evidence of a village in western South America bearing the name California. According to several old gazetteers, there are four villages named "California" in western South America. From the time of Meyen's visit to South America, some 126 years ago, some of the villages have undoubtedly acquired the name "California", such as the village, California, in Ecuador, which did not appear in gazetteers until about 1930. Two similarly named villages in Chile, one in the province of Tarapaca, the other in the province of Malleco, had populations of 502 and 84 respectively, in 1912. However, according to the log of Meyen's trip, the *Princess Louise* did not touch ports near either province. The only other town in western South

America bearing the name California occurs in the province of Santander, Colombia. This town had a population of 1,899 in 1917. However, it is located several hundred miles inland, a great distance to travel from a seaport during the 1830's. According to the ship's log, the *Princess Louise* proceeded as far north as Callao, Peru, and from there it passed directly to Honolulu, and then to Canton, China, failing to reach Ecuador and Colombia.

The Index to Maps of Hispanic America (Vol. I, Geographical Names in Central America, 1943) lists two villages with the name "California", both of which occur on the Pacific slopes of Central America, one in El Salvador, the other in Nicaragua. Thus we have the possibility that both Smith (*op. cit.*) and Mosauer (*op. cit.*) may have been correct in their assumptions. The type of *tuberculosus* could have been purchased from a sailor, and towns do exist in South America bearing the name "California".

Taylor's statement to the effect that "until the type of *tuberculosus* is rediscovered, the population to which the name *tuberculosus* must be applied will remain in question," may well be true, but Wiegmann did not designate a holotype and it appears that he had more than one specimen of *tuberculosus* at the time of its description. Wiegmann (*op. cit.*) discussed two and possibly more specimens in his original description. This suggests the possibility that some foreign museum may have at least part of the original series, even if the syntypes have been lost.

Through the kindness of Dr. Heinz Wermuth, Berlin Museum, Berlin, Germany, I was able to locate and borrow two syntypes of *P. tuberculosus*. It is reasonable to assume that these two specimens represent only a part of the original series that was housed in the museum associated with the Academy of Leopold Charles, Erfurt, Germany. In Wiegmann's original description, mention was made of some specimens with reproduced tails; neither of the syntypes has reproduced tails.

The following differences obtain between 120 specimens of *"tuberculosus"* from California and Baja California, and the syntypes of *tuberculosus*: (1) supralabials and infralabials in the Californian population vary from 13 to 15 and 12 to 14 respectively, rather than 12 and 13, and 9 and 10 respectively, in the syntypes; (2) dorsal tubercles are much larger in the syntypes than in any of the 120 Californian specimens examined; (3) the syntypes have 5 and 6 scales bordering the postmentals, whereas those of the Californian population range from 6 to 9 (M= 7.4); (4) the syntypes have the series of enlarged dorsal tubercles extending to the edge of the ventrals, whereas this is infrequent in the Californian population, in which normally 5 to 7 rows of granules separate the ventrals from the first row of enlarged tubercles on each side; (5) number of scales across snout between third labials in the Californian specimens is always less than or equal to the number of scales across midorbital region, whereas the reverse is true in the syntypes; (6) enlarged tubercles on dorsal surface of tail disappear at about second whorl from anus, rather than continuous to distal third of tail as in the syntypes (Table 1). The above characters definitely establish that the Californian population of *Phyllodactylus* is not the *"tuberculosus"* of Wiegmann. The application of the name *"tuberculosus"* must now be applied elsewhere.

	tuberculosus syntypes (2)	xanti (120)
No. of infralabials	9-10	12-14
No. of supralabials	12-13	13-15
Rows enlarged tubercles on dorsum	14-14	12-14 (M= 13.1)
Scales bordering postmentals	5-6	6-9 (M= 7.4)
Scales bordering internasals	5-7	5-8 (M= 6.6)
Scales between middle of eyes	16-18	15-23 (M= 19.3)
Scales across snout at third labials	22-24	14-21 (M= 16.8)
No undivided fourth toe lamellae	12-12	9-13 (M= 11.2)
Scales across venter	27-31	31-41 (M= 34.4)
No. tubercles in mid row dorsal series	31-35	32-40 (M= 37.0)
No. tubercules from axilla to groin	19-21	18-28 (M= 23.1)
Percent postmentals contacting two labials	100%	92.4%
Percent postmentals contacting one labial	0%	7.6%
Scales between eye and nostril	10-12	9-12 (M= 11.4)

Table 1. A comparison of certain characters of *Phyllodactylus tuberculosus* with a population of *P. xanti* from California and Baja California.

To ascertain the identity of the population that would bear the name *tuberculosus* I have examined approximately 2,000 specimens representing 41 species and subspecies of *Phyllodactylus* from the New World. Those forms without, or having minute rows of, enlarged tubercles on the dorsum are not referable to *tuberculosus*. Some of the forms having enlarged tubercles on the dorsum such as *pulcher, martini, wirshingi, ventralis, mulleri, julieni,* and *rutteni,* were eliminated on the basis of the high number of rows of enlarged dorsal tubercles. Such species as *abrupteseriatus, guayaquilensis, baessleri, heterurus,* and *lepidopogus* were eliminated because of a combination of characters: presence of denticular ear openings, absence of enlarged tubercles on tail, high number of orbital scales, ventral scales, postmental border scales, and scales across snout between third labials. The large tubercular forms occurring in Mexico were also eliminated because of the above characters, and in comparison with the syntypes of *tuberculosus,* the following differences obtain: (1) larger loreal scales when compared with the mid-orbitals; (2) larger terminal lamellae; (3) differences in the shape of the mental and postmentals.

Phyllodactylus darwini is the only species of the ten forms occurring in the Galapagos Archipelago which superficially resembles *tuberculosus*. The primary differences are: (1) ventral and ventrolateral scales well

differentiated in *tuberculosus,* rather than undifferentiated as in *darwini;* (2) ear opening non-denticulate in *tuberculosus,* whereas strongly denticulate in *darwini;* (3) reduced number of labials (5-6) to below center of eye in *tuberculosus;* 7-9 in *darwini. Phyllodactylus eduardofischeri* is the only remaining form which resembles the syntypes of *tuberculosus* and its range extends from Guatemala southward to southern Costa Rica.

I have examined specimens of *eduardofischeri* from scattered localities throughout its known range and have compared its characteristics with those of the syntypes of *tuberculosus.* Those individuals from the coastal region of southern Honduras, El Salvador, and northern Nicaragua are in complete accord with the characters exhibited by the syntypes of *tuberculosus.* Those from northern Guatemala and southern Costa Rica are less similar to the syntypes but fall well within the range of variation expected for *tuberculosus* (Table 2). A direct comparison of specimens of *eduardofischeri* with the syntypes of *tuberculosus* does not reveal significant differences in any of the cryptic characters. Meyen must have purchased the specimens from someone who collected the specimens in Central America, rather than in the state of California, Baja California, or South America.

Since it has been demonstrated that the syntypes of *tuberculosus* are nearly identical with specimens of *eduardofischeri* from northern Nicaragua, I restrict the type locality of *P. tuberculosus* to the village of California, Nicaragua, and place *eduardofischeri* as a synonym of *tuberculosus.*

Wiegmann's original description of *tuberculosus* does not give many characters now used to identify species within the genus. Therefore, redescription of *tuberculosus* based upon the larger syntype is as follows (The two syntypes have identical catalogue numbers, Berlin Museum 412):

Adult ♂, from "California", (probably California, Nicaragua), collected about 1833, collector unknown. Rostral twice as wide as high, its dorsal edge almost straight, slightly curved upward at outer edges; no medial groove extending to lip; internasals two, somewhat rectangular with median edges in board contract, bordered posteriorly by four granules and postnasal of each side; nostril surrounded by rostral, internasal, labial, and two postnasals, its ventral edge in broad contact with first labial; slight depression in frontal region; 12 scales between eye and nostril; posterior dorsolateral loreals about three times larger than mid-interorbital scales; 16 scales across snout between second labials, 22 between third labials; 13 scales between anterior edge of orbits; 16 between middle of orbits; eye large, contained in snout length slightly more than one and one half times; eyelid with two rows of granules and larger outer row of scales, the latter with posterior half bearing short spines on outer edges; diameter of ear contained in diameter of eye slightly more than twice; ear opening not denticulate, anterior margin with slightly pointed scales, scarcely protruding posteriorly into ear opening; top and rear of head with irregular-sized granular scales intermixed with larger rounded and somewhat elevated tubercles; 12 supralabials, fifth to center of eye; nine infralabials, fourth to center of eye; mental as wide as long, somewhat lyre shaped, bordered posteriorly by two triangular postmentals; postmentals separated about one half their length by posterior projection of mental; postmentals followed by transverse row of five scales, followed by second row of 11 smaller scales; postmentals contact first and second labials.

	tuberculosus	eduardofischeri				
	syntypes	Guatemala	Honduras	El Salvador	Nicaragua	Costa Rica
Number of specimens in sample	2	7	13	2	6	22
Scales bordering postmentals	R = 5-6 M = 5.5	R = 4-9 M = 6.9	R = 5-9 M = 6.6	R = 5-6 M = 5.5	R =4-7 M = 5.8	R = 4-6 M = 4.9
Scales between orbits (not including eyelid scales)	R = 16-18 M = 17.0	R = 16-21 M = 19.0	R = 17-21 M = 19.3	R = 17-17 M = 17.0	R = 15-17 M = 16.3	R = 16-23 M = 19.2
Scales across snout at third labial	R = 22-24 M = 23.0	R = 23-25 M = 24.7	R = 22-27 M = 23.5	R = 24-25 M = 24.5	R = 20-27 M = 24.7	R = 21-28 M = 23.3
Scales across venter	R = 27-31 M = 29.0	R = 27-30 M = 29.0	R = 26-31 M = 28.9	R = 29-32 M = 30.5	R = 28-29 M = 28.4	R = 25-33 M = 30.3
Rows of enlarged tubercles across dorsum	R = 14-14 M = 14.0	R = 13-16 M = 14.1	R = 14-16 M = 14.8	R = 16-16 M = 16.0	R = 14-16 M = 15.2	R = 14-16 M = 14.9
Scales between nostril and eye	R = 10-12 M = 11.0	R = 12-14 M = 13.4	R = 11-14 M = 12.4	R = 12-15 M = 13.5	R = 11-13 M = 12.2	R = 10-12 M = 11.5
Scales bordering internasals	R = 6-7 M = 6.5	R = 6-7 M = 6.9	R = 5-8 M = 6.6	R = 6-7 M = 6.5	R = 6-8 M = 6.7	R = 6-8 M = 7.3
Tail tubercle reduction	6-4-2	6-4-2	6-4-2	6-4-2	6-4-2	6-4-2 8-6-4-2
Postmentals touching 1 labial Postmentals touching 2 labials	1 = 0% 2 = 100%	1 = 42.9% 2 = 57.1%	1 = 15.4% 2 = 84.6%	1 = 0% 2 = 100%	1 = 8.3% 2 = 91.7%	1 = 15.9% 2 = 84.1%

Table 2. A comparison of certain characters of *Phyllodactylus tuberculosus* with populations of *Phyllodactylus eduardofischeri* from Central America.

Dorsum with 14 longitudinal rows of enlarged, trihedral tubercles, ten rows reaching head, six to base of tail; 35 tubercles in median row of enlarged dorsal tubercles from rear of head to base of tail, 19 between axilla and groin; two median rows of enlarged dorsal tubercles separated by three rows of granules; each tubercle of enlarged dorsal series separated from preceding tubercles by one to three granules; three postanal tubercles on either side of anus, well differentiated and slightly elevated; 31 scales across venter, 65 from gular region to vent.

Ventral and anterodorsal surfaces of limbs with cycloid scales, posteroventral surfaces granular; lower arm and leg somewhat granular with scattered large, trihedral tubercles intermixed; lamellae formula for hand 7-9-10-13-9 (undivided, 6-8-9-12-8), foot 6-9-12-13-12 (undivided, 5-8-11-12-11); claws moderate, tip and portion of claw visible when viewed from below; terminal pads somewhat rounded at tips; tail broken but mended with wire; dorsal surface of tail with 6-4-2 reduction in enlarged transverse rows of tubercles, distal one third of tail without tubercles.

Measurements in mm : s-v length 55.5; width of head 11.0; length of head 17.0; axilla to groin 27.0; length of leg 22.5; length of arm 17.5; length of snout 6.3; diameter of eye 3.8; diameter of ear 1.5.

Color in alcohol: Light tan, no color pattern visible; venter with minute blackish spots, several to a scale. The following color notes from Wiegmann:

"The color of the dorsum is light gray with black-gray spots, the tail is black-gray ringed; ventral surfaces whitish."

Variation: The smaller syntype is also an adult ♂. The amount of individual variation of this syntype and of the population is given in Table 1.

Distribution: The range of this species is not well defined. Specimens from northern Guatemala appear to be intergrades between *tuberculosus* and *magnus,* the latter having been collected in Chiapas, Mexico, but not recorded from Guatemala. Another series of *tuberculosus* from El Rancho, Guatemala, seemingly are intergrades with an undescribed *Phyllodactylus* from mainland British Honduras. The southern extremity of the range is near San Jose, Costa Rica. However, there is no reason to discount its probable occurrence along the drier Pacific slopes of Panama. There appears to be a large hiatus between the southern most record of *tuberculosus,* at San Jose, Costa Rica, and the northern most of *ventralis,* at Santa Marta, Colombia, a distance of approximately 700 miles. *Phyllodactylus* inhabits a xeric type of habitat almost entirely. A dense tropical rain forest occupies 500 of the 700 miles separating the two species.

By restricting the type locality of *P. tuberculosus* to the coastal village of California, Nicaragua, the name *P. xanti* Cope, then becomes available for the population in southern California and Baja California. Cope (1863) described *P. xanti* from Cape San Lucas, Baja California. O'Shaughnessy (1875) placed *xanti* in the synonymy of *tuberculosus* on the basis of the small hexagonal ventral scales "which affect a circular form", and on the assumption that both occurred in California.

The type of *xanti* is apparently lost and its original description is brief and leaves much to be desired in the way of details regarding the species. The following description is based on a specimen in the collection of Stanford University Natural History Museum (15867), and on the analysis

of variation of 119 specimens housed in the American Museum of Natural History; Academy of Natural Sciences, Philadelphia; Chicago Natural History Museum; Museum of Comparative Zoology, Harvard; Museum of Vertebrate Zoology, University of California; San Diego Society Natural History Museum; United States National Museum; private collection of L. M. Klauber and of the author.

A subadult ♀, from Cabo San Lucas, Baja California. Rostral slightly more than twice as wide as high, its dorsal edge straight but slightly curved upward at outer edges; short vertical groove in center of rostral about one third height of rostral; two rectangular internasals, their median edges in contact, bordered posteriorly by five granules and postnasal of each side; nostril surrounded by rostral, internasal, labial, and two postnasals, its ventral edge in narrow contact with labial; slight depression between internasals and in frontal region; 12 scales between eye and nostril; 24 rows of granules between eye and ear; dorsolateral loreals 4 to 5 times larger than interorbital scales; 13 scales across snout between second labials, 17 between third labials; 13 scales between anterior edge of orbits, 17 between middle of orbits; eye large, contained in snout length slightly less than one and one half times; eyelid with two rows of granules and one larger outer row of scales, the latter with about five posterior scales bearing spines; diameter of ear contained in diameter of eye one and one half times; ear opening not denticulate, anterior and posterior margins with rounded scales, the latter slightly smaller than the former; top and rear of head granular, with larger intermixed, rounded tubercles which are seldom keeled; 12 supralabials (sixth to center of eye); nine infralabials (fifth to center of eye); mental acutely angled posteriorly, length and width equal; two postmentals slightly wider than long, their median edges narnowly in contact; postmentals followed by transverse row of eight scales, followed by second row of 11 smaller scales; postmental contacting first labial on both sides.

Dorsum with 14 longitudinal rows of enlarged, keeled, somewhat flattened tubercles, eight reaching head, six to base of tail; 33 tubercles in median row from rear of head to base of tail, 17 between axilla and groin; two median rows of enlarged dorsal tubercles separated from each other by five or six rows of granules; each tubercle of enlarged dorsal series separated from preceding tubercle by 1 to 3 granules; three postanal tubercles on either side of anus, not well differentiated, rounded; 35 scales across venter, 62 from gular region to anus.

Ventral and anterodorsal surfaces of arm with large cycloid scales, posteroventral surface granular; forearm with large rounded tubercles intermixed with granules; cycloid scales of upper arm frequently ovate and weakly keeled; anterodorsal and ventral surfaces of leg with cycloid scales; posterodorsal surfaces granular with many enlarged rounded and/or trihedral tubercles intermixed; lamellae formula for hand 8-10-10-12-10 (undivided 5-6-10-10-8), foot 8-10-12-14-13 (undivided 6-8-10-9-11); claws moderately long, visible when viewed from below and extending beyond tips of terminal pads; terminal pads slightly rounded at tips; tail with longitudinal series of widened scales on ventral surface; proximal one fourth of dorsal surface of tail with a 6-4-2 reduction in enlarged tail tubercles, remaining three fourths of tail without enlarged tubercles;

granular scales of dorsal surface of tail approximately twice the size of those on dorsal surface of body.

Measurements in mm: s-v length 36.0; width of head 6.7; length of head 12.0; axilla to groin 13.6; length of leg 14.7; length of arm 9.5; length of snout 3.8; diameter of eye 2.6; diameter of ear 1.1.

Color in alcohol: Ground color fawn; dorsum with five dark brown transverse bands, slightly narrower than ground color interspaces, covering two transverse and six longitudinal rows of enlarged dorsal tubercles; brownish line from nostril through eye to along side of neck; brown spot just above arm insertions; head, snout, labials, and dorsal surfaces of limbs spotted with brown; ventral surfaces cream, each scale of belly with 1 to 2 minute brown dots, becoming more profusely dotted toward sides of body.

Variation: No sexual dimorphism is evident except for the absence of cloacal bones in females. The snout-vent length in all age classes examined varied from 28 to 72 mm. (M= 50.5); enlarged series of tubercles across dorsum 12 to 14 (M= 13.1); scales bordering postmentals 6 to 9 (M= 7.4); scales between nostril and eye 9 to 12 (M= 11.4); scales bordering internasals 5 to 8 (M= 6.6); scales across head between middle of eyes 15 to 23 (M= 19.3); scales across snout at third labials 14 to 21 (M= 16.8); undivided lamellae of fourth toe 9 to 13 (M= 11.2); scales across venter 31 to 41 (M= 34.4); number of tubercles in median row of enlarged dorsal series 32 to 40 (M= 37.0); axilla to groin 18 to 28 (M= 23.1). Of the 119 specimens, 92.4% have the postmentals contacting two labials on each side, 7.6% have the postmentals contacting a single labial on each side. There are two postmentals in all but four individuals which have three. The number of scales between orbits is equal to or is always more than the number of scales across the snout between the third labials. Color pattern varies from crossbands to spots, and the venter is always cream with a few brown dots.

Lizards inhabiting the Tropical Deciduous Forest of the cape region of Baja California differ somewhat from those found in the mesquite-grassland and chaparral vegetation farther north. The major differences noted are: Persistent crossbanding of the dorsum; enlarged tubercles present on the posterodorsal surfaces of the femur; postmentals contacting only the first labial on each side; and, frequently, more prominent tubercles on the dorsal surface of the tail.

The range of *xanti* extends from San Diego and Imperial Counties, California, to the tip of the cape region in Baja California. It has been taken on nearly every island (24) in the Gulf of California with the exception of Isla Santa Inez, Isla Tortuga, Isla Smith, and Isla San Luis. The islands of Cerralvo, Espiritu Santo, Ballena, and Partida (S) are inhabited by another species, *P. unctus*.

While examining the *P. tuberculosus* material several specimens from British Honduras collected by Dwight D. Davis and catalogued as *P. lanei* by K. P. Schmidt (1941) were found to be distinct from both *tuberculosus* and *lanei*. When compared with all of the known forms of *Phyllodactylus* inhabiting the New World, they appear to be related to insular species occurring on some of the islands of the West Indies and Puerto Rico. Since this population from British Honduras appears to represent an unnamed species, I propose that it be known as

Phyllodactylus insularis sp. nov.

Type: Chicago Natural History Museum No. 34633, adult ♂, from Half Moon Cay, British Honduras, collected by Dwight D. Davis, January, 1940.

Paratypes: CNHM 34630-34632, 34634-34636 (6), all topotypes.

Diagnosis: A moderate sized *Phyllodactylus* with 16 to 18 longitudinal rows of enlarged dorsal tubercles, which are much smaller and more numerous than those found on *Phyllodactylus* inhabiting the adjacent mainland. Ground color chocolate brown with indistinct undulating cross-bands or spots of grayish white.

Description of Type: Rostral twice as wide as high, dorsal edge straight, curving only at nostrils; internasals broader than long, bordered posteriorly by eight scales; nostril surrounded by rostral, labial, internasal, and two postnasals; deep depression in frontal and interorbital regions; 25 scales across snout between second labials, 29 between third labials; 13 scales between eye and nostril; second supralabial separated from nostril by two granular scales and postnasal; diameter of eye contained in snout length more than three times; 24 scales between anterior edge of orbits, 23 between middle of orbits; ear opening slightly denticulate posteriorly; diameter of ear contained in diameter of eye about four times; three rows of granules and one outer row of larger scales on eyelid, last ten scales of latter row bearing extremely pointed spines; posterodorsal surface of head granular with larger intermixed tubercles; seven supralabials and five infralabials to point below center of eye; mental slightly wider than long, followed by two postmentals which are twice as wide as long, contacting first labial of each side only; seven scales border postmentals posteriorly, followed by second transverse row of 14 smaller scales; second infralabial largest in series, about one third larger than first infralabial.

Upper arm with flat, imbricate scales on dorsal surface, posteroventral surface granular; posteroventral surface of forearm with slightly rounded, elevated scales, those of the dorsal surface cycloid, imbricate; scales on dorsal, anterodorsal, and ventral surface of femur cycloid, posteroventral surface granular; dorsal surface of lower leg with small conical scales intermixed with larger trihedral tubercles; terminal pads of toes and fingers twice as long as wide, extending beyond insertion of claws; claws completely hidden when viewed from below; lamellae formula for hand 6-8-9-11-10, foot 8-9-12-14-11.

Dorsum with 16 longitudinal rows of enlarged trihedral tubercles, all of which reach rear of head, eight reach base of tail; 44 tubercles in median dorsal row from rear of head to base of tail, 31 between axilla and groin; 29 scales across venter, 66 from gular region to anus; scales of venter abruptly differentiated from lateral scales; four large postanal scales on either side of anus; postanal region swollen; tail annulated, ventral surface with series of widened scales which are frequently divided; proximal fourth of dorsal surface of tail with eight rows of enlarged tubercles, which reduce to four at about middle of tail; distal fourth of tail without enlarged tubercles.

Color in alcohol: Ground color of dorsum, head, and tail chocolate brown; small areas of burnt brown form indistinct series of spots on head and dorsum; mid-dorsal region with longitudinal, narrow dark brown line,

extending from rear of head to base of tail; dorsal surfaces of limbs colored as dorsum; head with fewer dark spots and slightly lighter in color, with several small whitish spots intermixed; entire dorsum with whitish spots covering 1 to 3 scales, forming indistinct undulating cross-bands; whitish stripe beginning behind nostril, passing through eye to insertion of arm bordered below by dark chocolate brown stripe; labials heavily pigmented with dark brown; venter and ventral surfaces of limbs and tail yellowish brown; each ventral scale with 8 to 10 dark brown spots; chin and throat a little lighter than venter.

Measurements in mm.: Total length 118, s-v length 58, length of arm 18, length of leg 25, axilla-groin 27, length of head 19, width of head 12, length of snout 12, diameter of eye 5, diameter of ear 2.

Variation: Little variation was observed in the six paratypes. The number of labials is constant in all but one, which has six supralabials reaching to a point below center of the eye. Postmentals are two in five, three in one, and contact the first labial of each side in all. First transverse series of gular scales, following the postmentals, varies from 6 to 9, seven being most common. The scales bordering the internasals vary from 7 to 8; scales between the eye and nostril vary from 12 to 15. Scales across the snout between the third labials vary from 27 to 32, and those in the mid-orbital region range from 23 to 25. Longitudinal rows of enlarged dorsal tubercles range from 16 to 18, of which eight reach the base of the tail in all. Scales across the venter vary from 29 to 33, and the number of undivided lamellae under the fourth toe range from 10 to 13.

All six paratypes have a distinct whitish spot below the eye. This spot is less distinct in the type than in the paratypes. When viewed from above the white loreal stripe appears as an inverted V-shaped mark on the snout. Four of the type series have faint whitish cross-bands on the body, the others appear as rows of spots. The tail has narrow dark brown crossbands, with whitish interspaces 3 to 4 times wider than the adjacent dark bands. CNHM No. 34631 has a slightly lighter ground color than the rest of the type series.

Comparisons: *P. insularis* differs from specimens of *Phyllodactylus* from the adjacent mainland as follows: (1) fewer scales bordering postmentals (M= 7.1), rather than mean of 8.2; (2) smaller and more numerous longitudinal rows of enlarged dorsal tubercules, 16 to 18, rather than 13 to 14; (3) higher number of scales between the eye and nostril, mean - 13.9, rather than mean - 11.2; (4) more tubercles in the median longitudinal row of dorsum and row between axilla and groin, 42 or more from rear of head to base of tail, rather than 30 or less, and 30 or more from axilla to groin, rather than 22 or less.

The scale characters of this species approaches those of *P. wirshingi* from Puerto Rico. However, individual tubercles of the enlarged dorsal rows are smaller, and there are more scales across the snout and venter, and bordering the internasals. The postmentals touch the first labial only in both species.

I wish to thank James A. Bohlke, Charles Bogert, Bryce C. Brown, Doris M. Cochran, William B. Davis, Robert F. Inger, Lawrence M. Klauber, George S. Meyers, Hobart M. Smith, Robert C. Stebbins, Heinz Wermuth, and Ernest E. Williams for the privilege of examining specimens in their care. I am grateful to William B. Davis, Robert F. Inger,

and Hobart M. Smith for criticism of the manuscript and helpful suggestions.

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ANOTHER RECORD OF *TANTILLA UTAHENSIS* FROM INYO COUNTY, CALIFORNIA.—Recent field work in Saline Valley, Inyo County, California, has resulted in the collection of an adult female of the relatively rare Utah black-headed snake, *Tantilla utahensis* Blanchard. The snake, number 452 in the Pomona College Collection, was collected by the author and Mr. Steve Balch June 8, 1959, on the east side of the Grapevine Canyon road at the south end of Saline Valley; elevation 4,030. It was found in one of four 5 quart cans buried in the ground. Other reptiles, all lizards, secured at this location in the cans were: *Sceloporus magister*, *Uta stansburiana*, and *Cnemidophorus tigris*. The area was surrounded by well-weathered granite boulders of varying sizes. Some of the species comprising the shrub vegetation were: *Dalea fremontii* var. *saundersii* (Parish), *Atriplex polycarpa* (Torr.) Wats., *Hymenoclea salsola* T. and G., *Haplapappus linearifolius* DC.

Scale variations and measurements (in millimeters) were: scale rows 15-16-15; gastrosteges 168; urosteges 68; anal plate 2; supralabials 7-8; infralabials 6-6; preoculars 1-1; postoculars 2-2; temporals 1-1; snout vent length 199; tail length 63.

According to Blanchard (1938. Zool. Series, Field Mus. Nat. Hist., 20 (28:373) there is a specimen of *T. utahensis* from the Panamint Mountains in the collections of the California Academy of Sciences, Number 65378; Surprise Canyon, Inyo County, California, collected by Mr. Joseph R. Slevin May 4, 1931; approximately 38 airline miles to the south of the Saline Valley locality. Judging from the information available, Slevin's specimen represents the only other record of this species from Inyo County. —*Benjamin H. Banta, Department of Zoology, Pomona College, Claremont, California.*

NOTES ON THE SOFT-SHELLED TORTOISE *MALACOCHERSUS TORNIERI* (SIEBENROCK).—The habits of the shy, rock-dwelling tortoises of genus *Malacochersus* from Tanganyika and Kenya have been studied from relatively few individual specimens although a comparative abundance of material has been available for morphological study. Several observations have now been made on 2 juvenile specimens received on May 23, 1959. Both showed swift adaptation to captivity, the larger tortoise accepting lettuce 9 minutes after being placed in the isolation tank. On June 2 the *tornieri* were promoted to a shelf measuring approximately 14 x 50 inches. Their cryptozoic inclinations were accommodated with two identical, sturdy cardboard boxtops, each measuring 12 x 12 inches in the plane and 1⅜ inches in height, placed at each end of the shelf and weighted down with rocks.

In their natural habitat, soft-shelled tortoises occur in congregations. Loveridge (1944:176) once "located 2 . . . batches of the reptiles in crevices or beneath rocks," and his assistant ". . . found 11 under a single flattish boulder. . ." (*op. cit.*:180). However, the apparent gregariousness of *tornieri* may be dictated by a dearth of suitable rock crevices. With this thought in mind I frequently checked the shelter preference of my specimens and also of a juvenile *Testudo hermanni hermanni* Schneider, which was moved to the enclosure on June 17.

Recorded observations were made from August 6 to November 11, a period comprising 98 days. Fifteen days had to be subtracted because of failure, through weekend absences, etc., to inspect the hiding places, and on 16 days the *tornieri* did not leave their retreat(s), judging by the appearance of their food and amount eaten. The rapidly growing *hermanni*, habituated to Purina dog food and scornful of vegetable fare, did not miss a daily meal once in the 83 days that observations were made. The *tornieri*, in agreement with the findings of Mertens (1942:247), have so far refused dog food or meat.

During the 67 days on which all tortoises in the enclosure had emerged the *tornieri* were discovered sharing a retreat on 44. The 2-1 (44-23 days) ratio may be taken as evidence of social behavior. By way of contrast, the *hermanni* was found in the company of the two *tornieri* on only 21 of the 44 days during which this combination was possible.

If not disturbed, the soft-shelled tortoises would usually try to return to the retreat from which they had emerged. Once, in July, having found the re-entry blocked with a thin strip of cardboard, one of the *tornieri* attempted for 4 minutes to find "the eye of a needle," then repaired to the alternate retreat.

The recording of shelter preference had to be discontinued after November 11 because one boxtop had begun to sag from the weight of the stones, the tortoises choosing the now roomier housing. Since their carapace depths of 30 and 29 mm still permitted them to worry their way under the sagging shelter, their preference was tantamount to avoidance of work. Mertens writes (1937) that the soft-shelled tortoise chooses *always* (first italics mine) *narrow cracks* in the rock as its retreat; on the other hand, Loveridge captured (1933) 5 *tornieri* "under shelter of rocks but exposed." The incident with the sagging boxtop also indicates that the soft-shelled tortoise may have no particular instinct to seek out the *narrowest possible* retreat.

A boxtop 2¼ inches in height was subsequently placed at the other end of the enclosure for three days. On the first day, both soft-shelled tortoises came out to nibble in the late afternoon and returned to the old shelter without walking past the feeding area. On the second and third days, however, they availed themselves of the new boxtop. Each time their stay was brief. The 29-mm tortoise repaired to its old diggings after 30 and 45 minutes, respectively; the 30-mm one took 4 and 5 hours to follow suit. After staying under the high-ceilinged retreat for about 2 hours on the second day, the latter tortoise was seen approaching the low shelter, pausing, and then returning to the high shelter.

Observations over a longer period of time and with more variously sized retreats are needed before any conclusions can be reached about the shelter preference of this species. Unfortunately, the high boxtop necessary for this experiment proved too tempting for the *hermanni*. Although on the first day it twice took the pains to scrabble under the low shelter, it was constantly found under the high shelter on the following days. Forced previously to live under the same roof with the pancake tortoises, the European tortoise had been developing a shell quite like that of its depressed companions. (This unusual adaptation will be the subject of a separate paper.)

In considering the cryptozoic preferences of the genus, mention must be made of the as yet uncertain *M. procterae* (Loveridge), of which only 2 specimens (one unverified) have been captured. The carapace of the only preserved specimen is distinguished by its greater degree of ossification than in *tornieri* and by an unusual vertebral keel. The shell is about twice as deep as that of a *tornieri* of the same size. I submit that these variations are connected with the mode of life of the specimen under consideration.

Although Loveridge (1923) does not hint at this connection, he describes the country around Ikikuyu (type locality for *procterae*) as being different from that of Dodoma (type locality for *loveridgii* Boulenger = *tornieri*) "in that there are no essentially rocks *kopjes*, though there are small hills with fairly numerous scattered boulders." The type specimen was found on fairly level country, about a mile from the nearest mountain slopes. Its shell characteristics could be interpreted as an adaptation to survive on more even terrain where the cryptozoic instinct is less of a lifesaver than in a country studded with rocky *kopjes*. Thus the urge to crawl into narrow openings may not be equally developed among the members of the genus.

On November 14, the sturdy boxtop was moved to the position of the defective one, which was scrapped. It took the soft-shelled tortoises 17 and 22 minutes respectively to disappear into the retreat (about ¾ths of these time periods taken out for feeding on the way) as compared with the 51 minutes taken by the *hermanni*, who walked around confusedly, trying to hide under scraps of paper.

I can confirm the indifference of the soft-shelled tortoises toward other tortoises as reported by Mertens (1942:249). In the present enclosure, they leg it past the craning *hermanni* without paying the slightest noticeable attention. Its constant attentions, marginal nudgings, and endeavors to mount while the others are eating, are disregarded. The *tornieri* showed complete indifference also toward a *Geochelone elegans*

(Schoepff) temporarily placed in the enclosure, whereas the latter would follow them around, persistently nosing their marginals.

Before the arrival of the *hermanni,* no glass front had been fitted for the shelf containing the soft-shelled tortoises though it was 5 feet off the ground. The *tornieri* were found to have a keenly developed sense of height and would not approach closer than 1 cm to the edge of the shelf.

With two thermostats guaranteeing a night temperature of 78-80° F. and a daytime temperature of 86-88° F., the *tornieri* have made the following monthly gains, expressed in carapace length over weight (millimeters over grams):

June 1	July 4	Aug 1	Sept 1	Oct 1	Nov 1	Dec 1
86	92½	96	99	102	104	105
100	115	122	140	140	161	150
95	99	100½	103	104	107	107½
115	125	140	149	153	162	152

So far, no softening or fenestration of carapace or plastron has taken place, although the abdominals yield slightly to pressure. The hard shell may be adducible to the high mineral content of the food prepared for the tortoises.

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Arsene Eglis, 41-72 Denman, Elmhurst, N. Y.

AN ABERRANT TORTOISE FROM CEYLON.—In describing variations in scutation among insular *Geochelone elegans* (Tetrapod Reptiles of Ceylon, Vol. 1), P.E.P. Deraniyagala states that extra costals in this species are "rare and usually occur on the right side." All 7 divergent individuals tabulated by him have the normal number of 4 costals on the left side. Of interest, therefore, is a 150-mm male owned by Dr. Paul Wohl of New York City. This specimen has 3 extra costals, 1 on the right side and 2 on the left. The 3 shields are about 1/5 the size of a normal costal and are wedged in at the expense of the vertebrals, which have a crowded appearance.

Another male in the group of five tortoises imported had an extra costal on the left side.—*Arsene Eglis, 41-72 Denman, Elmhurst, N. Y.*

The Invasion of Bali by *Bufo melanostictus**

By GILBERT CHURCH

Introduction

Bufo melanostictus Schneider, the common toad of Southeast Asia which is found from India and the Himalayas to Southern China, and south throughout the Malay Peninsula to the islands of Sumatra and Java, Boulenger ('12), has never been reported from Bali, Mertens ('30). Van Kampen ('23), in fact, does not include the easternmost extremity of Java in its range. In view of the ubiquity of this species in Western Java its absence from the eastern extremity of Java and from Bali seemed the more surprising, and an effort to collect it in those two areas was made.

In July, 1958, 111 female and 56 male of *melanostictus* were collected in one evening in the town of Banjuwangi at the easternmost tip of Java, Figure 1. They were preserved in formalin and measured upon returning to Djakarta. It was found that the range in size was greater in females than in males, but there was no significant difference between the mean snout-vent lengths of the two sexes, Table 1. This finding, which is typical of a number of populations of this species throughout Java (Church, 1959), is at variance with the observations of Liu ('36) who reported marked sexual dimorphism in size—the females being larger—for this species in China.

In August, 1958, 87 female and 69 male *melanostictus* were collected one evening in Negara, West Bali, Fig. 1. As in Banjuwangi, the range in size of females was greater than the males, but unlike those of Banjuwangi, the mean snout-vent length of the females was significantly greater than that of the males, Table 1. Considered as a group, the Negara *melanostictus* were considerably larger than those from Banjuwangi, but they compared favorably with the average size established for the species on Java by Church (1959). A comparison of the means of the two groups is also given in Table 1.

An extensive search was made for *melanostictus* east of Negara but only *biporcatus* was found. Even in the first village eight kilometers east of Negara, *melanostictus* was not to be found and was unknown to the inhabitants. The same was true of East Bali from Singaradja on the north coast to Den Pasar and Ubud in the south, and Klungkung and Karang Asem on the eastern tip of the island. There were no *melanostictus*, but *biporcatus* was present everywhere in East Bali in abundance.

Discussion: *Bufo melanostictus* is undoubtedly a recent immigrant to Bali. There is considerable evidence to suggest that the species has crossed over from Java and begun to be dispersed on Bali in comparatively recent times. Such an invasion of a new island and a new territory by an amphibian is not without precedent. *Bufo marinus* is known to have been introduced into the Philippines in 1934 (Rabor, 1952). Its dispersal there is continuing, and Rabor believes that in some places *marinus* is driving out and diminishing the native amphibian populations apparently through larval competition at the spawning sites. *Bufo marinus*, with the help of man, is also known to have invaded such widely separated places as Ber-

*This study was supported by the Gustav and Louise Pfeiffer Research Foundation and the China Medical Board of New York City.

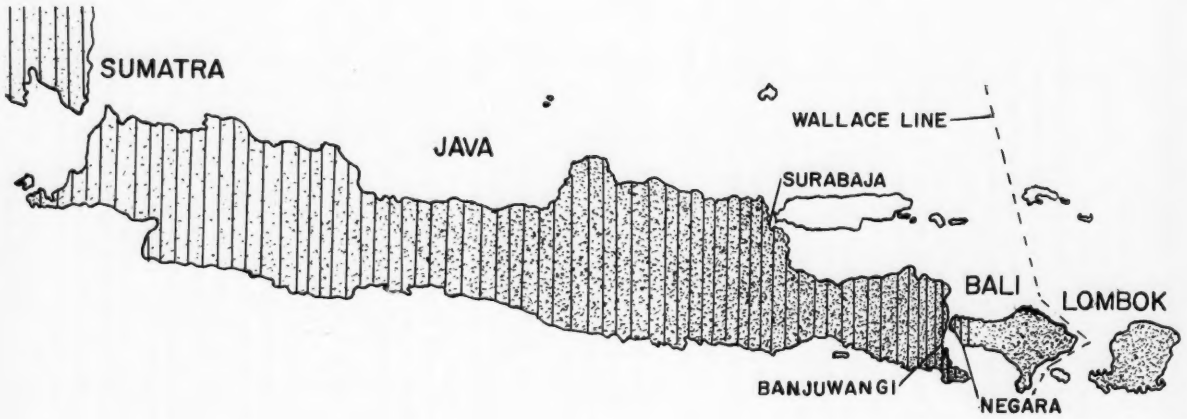

Fig. 1. The extent of the range of *Bufo melanostictus* is shown by vertical cross-hatching; that of *B. biporcatus* by stippling. The increased abundance of *biporcatus* in the eastern extremity of its range is indicated by heavier stippling.

muda, the Hawaiian Islands, the Marianas, the Solomons, and the Admiralty Islands (Inger, 1954).

Kirtisinghe (1957) has reported the recent introduction of *Bufo stomaticus* into Ceylon from the Indian mainland where it is widely distributed. In Ceylon its range is limited to one locality. Parker (1934) suggests that *Kaloula pulchra*, which is known to have been introduced into the island of Singapore, was also introduced by man into Sulawesi, where it is limited to Makassar, and perhaps also to the islands of Kalamantan and Flores.

At the present time *melanostictus* is limited to the western tip of Bali. However, the large size and the aggressive behavior of this species, the hardiness of the larvae which are known to be able to withstand even brickish water (Strahan, 1957), and its demonstrated ability throughout the rest of its range to adapt successfully to almost every possible habitat

Table 1. Differences in mm. in snout-vent lengths of *Bufo melanostictus* from Banjuwangi (East Java) and Negara (West Bali).

Place	No.	Range	Mean±SE	M_1-M_2	$3(SE_D)$
Banjuwangi:					
Females	111	41-86	58±.33)	3	2.38
Males	56	48-77	61±.69)		
Negara:					
Females	87	53-96	72±1.42)	9	4.50
Males	69	54-78	63± .56)		
Total:					
Banjuwangi	167	41-86	59±.24)	9	2.67
Negara	156	53-96	68±.86)		

from tropical sea level to high in the mountains, would suggest that it is a new arrival and that in time it will invade the remainder of the island.

Actually, there are no natural conditions to hinder this invasion. No obvious ecological differences exist between Java and Bali. There is no difference between the two islands in terrain, and there are no geographical barriers on Bali to limit the species to the western tip and hinder its dispersal eastward.

No significant difference exists between East and West Bali in humidity, rainfall and temperature nor does Bali differ from East Java in these conditions. However, the repetition of a statement initially engendered by Wallace (1890) has led a number of writers including Mayr (1944) and deBeaufort (1951) to assume that the Lesser Sunda Islands are "arid" during part of the year. Presumably this "aridity" should affect the amphibian population patterns in these islands. While it is true that the normal amount of moisture decreases in the Archipelago as one goes eastward and that there are seasonal changes in the amount of rainfall, as far as Sumatra, Java, Bali, and Lombok are concerned, the decreased rain-

fall during the so-called "dry" season is not of an order to produce drought conditions, and it is certainly great enough to sustain amphibian populations. Significantly, two species on Java at least have been shown to maintain continuous breeding condition throughout the year (*B. melanostictus*: Church 1959; *Rana chalconota*: Liem, 1959). Table 2, compiled from data furnished by the Lembaga Meterorologi dan Geofisik, Djakarta, (Schmidt & Ferguson, 1951) lists rainfall and humidity averages for these regions. The difference between the average monthly temperature of Djakarta (25.6°-27.5° C.) and Den Pasar (26.0°-28.3° C.) is about one degree. It will be noted that contrary to the opinion of Mayr (1944) there is no significant difference in the humidity of these areas and none is "arid" at any time of the year.

It has been shown by Church (1958) that a constant supply of food

Table 2. Normal monthly rainfall in mm. (a); number of rainy days during month (b); and relative humidity in percent (c) for Java, Bali and Lombok. Data compiled by Lembaga Meterorologi dan Geofisik, Djakarta.

	JAVA						BALI			LOMBOK		
	Djakarta			Banjuwangi			East Bali			Mataram		
Month	a	b	c	a	b	c	a	b	c	a	b	c
Jan.	308	19	85	213	13	77	249	12	79	251	13	no data
Feb.	300	18	82	166	12	—	222	11	79	226	11	
Mar.	206	16	81	152	12	76	164	10	79	212	12	
Apr.	143	9	80	85	7	74	136	6	79	271	8	
May	112	7	82	82	7	79	83	6	79	106	6	
June	91	7	84	88	6	77	93	6	81	87	5	
July	62	6	81	61	5	80	70	4	79	48	3	
Aug.	42	4	80	63	5	79	40	3	78	41	2	
Sept.	70	6	80	47	4	75	30	3	76	53	3	
Oct.	111	9	80	67	5	76	76	5	79	157	7	
Nov.	142	13	80	83	7	74	88	6	75	217	11	
Dec.	204	16	81	160	11	79	166	9	79	283	14	

is available to *melanostictus* throughout the year on Java. Given similar conditions of terrain and climate on Bali, a difference in food supply throughout the year would not be expected.

The similarities of morphologies also suggest that the Javanese and Balinese populations of *melanostictus* have not been separated for an extended period of time. Measurements of the Negara population and that of Banjuwangi show no significant differences when computed as ratios of snout-vent lengths. These data for the average head widths, head lengths, diameters of the right tympani and the diameter of the eyes are in Table 3. Obviously, no significant degree of speciation has taken place.

One factor slowing the dispersal of *melanostictus* on Bali may be its contact with *biporcatus,* a small, less active species which is found extensively on the island. However, there is evidence to indicate that *melanostictus* is gradually displacing *biporcatus* as it is dispersed eastward.

Both species are nocturnal and eurytropic except when they are found

in the same local areas. In West Java where *biporcatus* is less common than *melanostictus,* the latter prefers urban areas. It is rarely if ever found in the sawahs or in dense vegetation. It will even avoid dense grass, if possible, preferring the open, bare areas of playgrounds and churchyards. Its aggressiveness will often bring it onto porches and into houses to catch the insects flying around a light. On the other hand, in East Bali where *melanostictus* has not yet penetrated, *biporcatus* occupies not only the flooded rice sawahs, pools and streams, but also some of the areas that would be occupied by *melanostictus* if it were present. In between these two geographical extremes, the species are both found at Negara, West Bali, but in separate areas. There, *melanostictus* occupies its customary environment—the more urban, dryer open places of the town—and *biporcatus,* apparently pushed aside by *melanostictus,* is limited to the flooded sawahs and streams.

The ranges of the two species in the Archipelago are also significant; *melanostictus* is found abundantly in Malaya, Sumatra, Java and the western tip of Bali; *biporcatus* does not occur on the Malay Peninsula at all (Boulenger, 1912; Smith, 1930); it is apparently not abundant in Sumatra (Van Kampen, 1923); on Java it is rarely found in inhabited areas in the western

Table 3. Ratios of average head widths (HW), head lengths (HL), diameters of right tympanum (T), and diameters of eyes (E), to the snout-vent lengths (SV) of *melanostictus* from Banjuwangi (East Java), and Negara (West Bali). All measurements in mm.

	HW / SV	HL / SV	T / SV	E / SV
Banjuwangi	22.8 / 59.0 = .39	19.2 / 59.0 = .33	7.5 / 59.0 = .13	8.0 / 59.0 = .12
Negara	26.5 / 68.2 = .39	22.7 / 68.2 = .33	7.7 / 68.2 = .11	7.5 / 68.2 = .11

part of the island (approximately ten specimens were found in a collection of over two thousand *melanostictus* in the Djakarta area), nor is it abundant in suburban areas, but it exists in large numbers in Central and Eastern Java; it is also found abundantly in Bali, especially the eastern part; and a subspecies, *b. cavator,* has been reported from Lombok, the next island after Bali (Mertens, 1930). The more far-reaching range of *biporcatus* in the Indonesian Archipelago would suggest that it is the older species in this area.

Two facts emerge from these observations. A *biporcatus* population gradient, Fig. 1, is apparent which shows an increase in the numbers of *biporcatus* as the periphery of its range is approached; and wherever *melanostictus* is found, there are either no *biporcatus* in the area, or the local habitat of *biporcatus* is limited to areas not preferred by *melanostictus.* As *melanostictus,* the larger, more aggressive species, is dispersed south and eastward throughout the islands of Sumatra, Java and Bali;

biporcatus, as indicated by its east-west population gradient, is being limited more and more in its range or eliminated completely.

Only from future collections will it be possible to determine the rate at which these changes are taking place. That the changes will take place seems inevitable; *melanostictus* certainly has everything to its advantage: size, aggressiveness, hardiness, adaptiveness, prolificacy and favorable ecological and geographical conditions for its further expansion. The overall picture does not suggest that a static equilibrium has yet been established between the two species.

Summary

1. The range of *melanostictus* Scheider in the Indonesian Archipelago extends as far as Bali.

2. At the present time *melanostictus* is limited to the western tip of Bali. Evidence is presented to show that the further migration of this species on Bali is to be expected.

3. The morphological similarity of the populations of *melanostictus* of Java and Bali show no degree of speciation, indicating that geographical isolation of the two populations may have occurred in more recent times.

4. Evidence is given to show that *melanostictus* is invading, and competing for, territory already occupied by *biporcatus* and that wherever they come into contact, *biporcatus* is being either displaced or eliminated by *melanostictus*.

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MISSISSIPPI HERPS.—*Haldea valeriae valeriae*—The Eastern Ground Snake extends its range well into SE Miss. I have taken it as far west as Lamar County, extending the range about a hundred miles west.

Rhadinaea flavilata - A characteristic not mentioned in our most widely used keys for the identification of the yellow-lipped snake that never fails to separate it on sight from similar species is the tail length. In most cases the *Rhadinaea in Miss.* has a tail 1/3 the body length. A number of 10 inch specimens had 3½ inch tails, twice as long as in *Haldea, Tantilla* and *Storeria occipitomaculata,* and three times that of *Carphophis.*

Diadophis punctatus punctatus - I have taken the Southern Ringneck Snake westward into south Miss. as far as U. S. Hwy. 51. Several were taken as far NW as Brookhaven, and it is very common in the costal counties. Those taken show the characteristic spots in a central row on the belly consisting of large halfmoons. The neck ring is interrupted above by dark pigment and there are small black spots on the chin and lower lips. I have taken many in south central Miss. that show characteristics mixed with those of *Diadophis p. stictogenys,* suggesting that they intergrade in that area.

Amphiuma means means - The range of the two-toed *Amphiuma* extends westward to U. S. Hwy. 51 and has been collected as far north as Hazelhurst, Miss. I have taken it from large Miss. streams such as the Leaf, Chickasawhay and Pearl, which is a matter of interest because these animals are not reported to live in rivers.

Pseudotriton montanus flavissimus - The Gulf Coast Salamander extends its range north into Miss. as far as U. S. Hwy. 80 and west to U. S. Hwy. 51 which marks the divide between the Mississippi and Pearl Rivers. It is one of the most numerous salamanders in Miss. limestone caves.

These specimens are deposited in the Vertebrate Collection of the Gulf Coast Research Laboratory.—*William E. Brode. Gulf Coast Research Laboratory. Ocean Springs. Mississippi.*

SCELOPORUS G. GRACIOSUS IN SOUTHERN NEW MEXICO AND TEXAS.—During the summers of 1958 and 1959 specimens of *Sceloporus g. graciosus* were collected in sand dunes areas of Texas and southern New Mexico. These lizards are unique in having very light dorsal coloration and in their apparent restriction to sand dunes. They agree with *graciosus* in having granular scales on the posterior surfaces of the thigh and in the possession of widely separated femoral pore series.

In life the dorsal surfaces of the back, tail, limbs and head are beige; a light grey band runs along the lateral surfaces of the body from the front limbs to the end of the tail. Dorsal pattern of the young is much lighter. In June, gravid females have a yellowish hue and rust colored patches below the ear opening. The ventral surfaces are immaculate except for the two blue belly patches in the males.

Besides lacking normal dorsal color, these lizards are different from *graciosus* in totally lacking the blue mottling on the chin and throat in both males and females. Of fifty-two (21 females, 31 males) normal adult *graciosus* from Utah and northwestern New Mexico three females lacked this marking, possibly lost in preservation. Of eleven specimens of this light colored population (6 females, 5 males), only one had the slightest trace of blue on the chin, it was from Chaves Co., New Mex. The eleven specimens of this population examined were from Chaves Co., New Mex. (3), Ward Co., Tex. (2) and Winkler Co., Tex. (6).

The sand dunes region involved, covers rather large areas in Crane, Ector, Ward and Winkler counties, Tex. and ranges as far north into New Mex. as Ft. Sumner, De Baca Co. Dunes of a distinctly reddish sand are also found in this area but no *graciosus* have been seen or collected in them.

The lizards were most readily found among the dwarfed shin oak common at the edge of the active dunes. In August, young could be discovered by digging in the loose sand at the base of any vegetation large enough to provide shade. On June 20, 1959, four eggs were laid by a female, 56 mm s-v, from E. of Monahans, Ward Co. Egg length-width in mm: 14-8, 14-8, 14-8, 13-6, av. 13.8-7.5. On June 23, 1959, six eggs were laid by a female, 63 mm s-v, from Kermit, Winkler Co. Egg length-width: 12-8, 13-8, 13-8, 13-9, 15-9, 15-10, av. 13.5-8.6.

Normal specimens of *Cnemidophorus inornatus, C. tesselatus, Uta stansburiana stejnegeri, Holbrookia maculata* subsp. and *Crotalus viridus viridus* were also collected in these dunes.

I am indebted to Dr. W. F. Blair for making it possible to examine the *S. undulatus* and *S. graciosus* in the University of Texas collection; to Dr. Blair and Dr. R. C. Stebbins for providing comparative material of *S. graciosus* from the University of California Collection. —*Michael Sabath, 3212 West Dallas Avenue, Houston, Texas.*

A Comparison of a Javanese and a Balinese Population of *Bufo biporcatus* with a Population from Lombok*

By GILBERT CHURCH

In the southern islands of the Indonesian Archipelago *Bufo biporcatus* Gravenhorst has been found on Sumatra, Java, Bali and Lombok. However, considerable confusion has been manifest in the classification of the Lombok population. At various times it has been included in the same species as those from Sumatra, Java and Bali (Boulenger, '97; Roux,' 11); it has been set apart as a separate species, *cavator* (Barbour, '11); it has been divided into two species, *biporcatus* and *cavator* (Van Kampen, '23); and finally it has been separated as a subspecies, *biporcatus cavator* (Dunn, '28: Mertens, '30). In the literature available the characteristics listed to separate the Lombok animals either specifically or subspecifically from those of Sumatra, Java and Bali are:

1. The first finger of the toads from Lombok is as long as, or longer than the second (Van Kampen, '23; Mertens, '30), whereas in *biporcatus* in the rest of its range, the first finger is described as usually as long as, but rarely extending beyond, the second (Van Kampen, '23).

2. The tympanum of the Lombok animals is smaller and more circular than in other *biporcatus* (Barbour, '11; Van Kampen, '23; Mertens, '30).

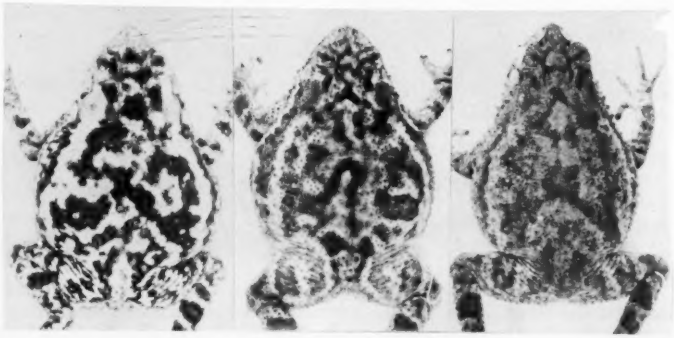

Fig. 1. Color patterns of *biporcatus* tend to become lighter from east to west in its range. Here are examples of the lightest patterns in three populations: (l. to r.) Mataram, Lombok; Klungkung, Bali; Udjong Kulon, West Java.

3. The tympanum of the Lombok animals is not enclosed above by the orbito-tympanic ridge as it is in other *biporcatus* (Barbour, '11; Van Kampen, '23; Mertens, '30).

*This study was supported by the Gustav and Louise Pfeiffer Research Foundation and the China Medical Board of New York City.

4. The cephalic crests of the Lombok animals are not prolonged as far posteriorly as in *biporcatus* from other areas (Barbour, '11).

5. The toes, except the fourth, are entirely webbed in the Lombok toads, whereas in other *biporcatus* the toes are not quite ½-⅔ webbed (Van Kampen, '23).

The results of a comparison of these characteristics in two typical populations of *biporcatus* from Java and Bali with a population of *biporcatus* from Lombok are presented.

The *biporcatus* used were collected in November and December, 1958. The population sample from Udjong Kulon, the game preserve at the westernmost tip of Java, was collected by A.M.R. Wegner, Director of the Zoological Museum, Bogor. The animals from Klungkung, East Bali, and those from Mataram, Lombok, were collected by me and my assistant, Dr. Sie Kian Tjong. All collections were made at night and the animals were preserved in 4% formalin.

Measurements were made of the snout-vent lengths; head widths; head lengths; vertical and horizontal diameters of the right tympani; diameter of the eyes; length of the right parotoid glands; and lengths of the right

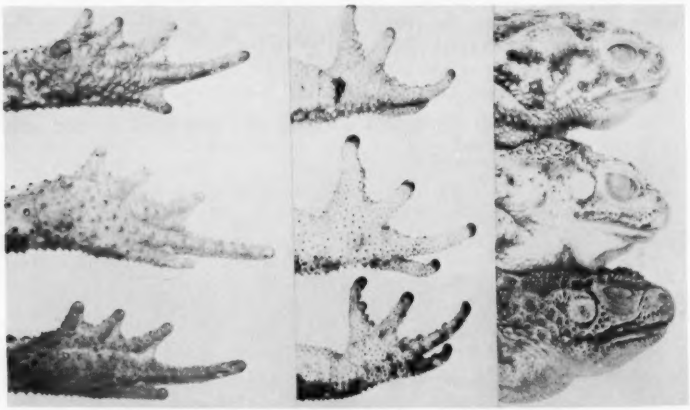

Fig. 2. Photographs illustrating the similarity of webbing between the toes; the similarity in the lengths of the fingers; and the possible occurrence of elliptoid and circular tympani in *biporcatus* from (top to bottom) Mataram, Lombok; Klungkung, Bali; and Udjong Kulon, West Java.

cephalic crests. Examinations were made to determine the relationship of the tympani with the orbito-tympanic ridges; the lengths of the first two fingers; and the webbing of the toes.

Results

1. *General description.* The animals from Klungkung, East Bali, were the largest; those from Udjung Kulon, West Java, the smallest of the three populations. The range and means of the measurements of the snout-vent, head width, head length, eye diameter, right parotoid gland

and right cephalic crest are in Table 1. The results of considering these means as ratios of the snout-vent means to overcome the differences in size of the three samples are in Table 2. No significant difference is evident between any of these characteristics in the three populations.

There was a considerable decrease in the amount of pigment between the animals from Udjung Kulon and those from Lombok, with a resulting change in pigment pattern. The change from one population to another as one moved eastward, however, was gradual and not clearly marked, the darker animals from Klungkung being comparable to the lighter ones from Udjung Kulon, and the darker animals from Mataram overlapping both the Bali and Java populations. The most extreme light pigment patterns of the three populations are shown in Fig. 1.

There was no significant difference between the three populations in skin texture, wartiness or spinosity, or in the size of the parotoids.

2. *The relation of the first finger to the second.* Examination of the three populations revealed no significant difference in the lengths of the first two fingers. Typical hands of the three samples are shown in Fig. 2.

Size of tympanum. Size was determined by multiplying the vertical by

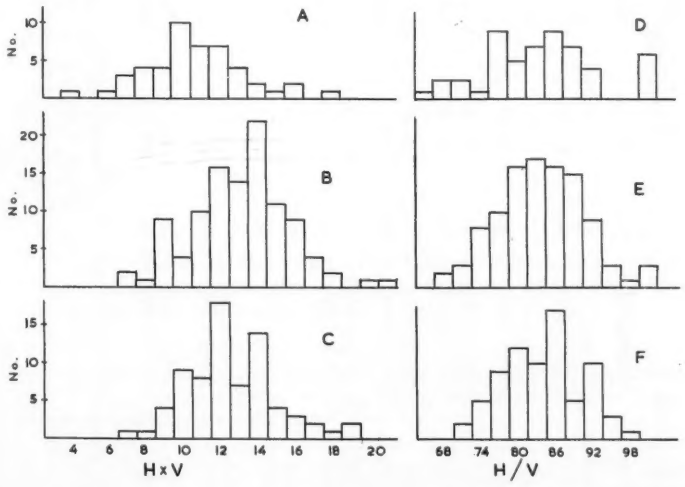

Fig. 3. Range and distribution of size (H x V) and shape (H/V) of tympani of *biporcatus*. Although the tympani of the Mataram, Lombok, sample (A) are somewhat smaller than those from Klungkung, Bali (B), or Udjung Kulon, West Java (C), the difference does not warrant separation into subspecies classification. The incidence of circularity of the tympani increases eastward, and a larger percentage of circularity is found in the Mataram sample (D). But again the difference is not great enough to separate it subspecifically from the Klungkung (E) and Udjung Kulon (F) samples, in both of which circular tympani also occur.

		Mataram			Klungkung			Udjung Kulon	
	No.	Range	Mean±SE	No.	Range	Mean±SE	No.	Range	Mean±SE
SV M	12	44-59mm	50.3±1.304	57	46-66mm	54.6±0.546	57	37-53mm	48.3±0.427
F	41	46-62	54.0±0.834	46	42-70	59.0±0.986	17	47-68	58.7±1.518
HW M	12	14-19	17.0±0.426	57	15-21	18.1±0.140	57	13-19	16.6±0.160
F	41	15-21	17.8±0.249	46	14-22	19.4±0.233	17	14-21	18.4±0.451
HL M	12	14-16	15.0±0.200	57	14-18	15.8±0.115	57	12-15	13.9±0.131
F	41	14-18	15.0±0.178	46	13-20	16.8±0.156	17	13-18	16.1±0.318
HxV M	12	8-15	10.8±0.342	57	9-21	13.-±0.354	57	7-15	11.9±0.260
F	41	4-19	11.3±0.503	46	7-21	13.4±0.387	17	7-19	12.8±0.347
E M	12	4.6-5.8	5.2±0.160	57	4.6-6.6	5.3±0.054	57	3.8-5.4	4.7±0.047
F	41	4.6-6.6	5.3±0.084	46	3.8-6.6	5.3±0.076	17	4.2-5.8	5.0±0.097
RP M	12	7.0-9.4	8.3±0.250	57	7.6-12.4	9.3±0.164	57	4.5-9.5	7.4±0.156
F	41	7.0-11.0	8.6±0.176	46	7.6-12.4	10.0±0.200	17	6.5-11.5	8.7±0.416
RC M	12	7.2-8.8	7.8±0.160	57	6.9-9.3	8.1±0.067	57	6.3-8.7	7.5±0.065
F	41	6.8-9.2	8.1±0.099	46	6.9-9.3	8.3±0.110	17	6.9-9.9	8.5±0.177
H/V M	12	.67-1.0	.84±0.023	57	.70-1.0	.79±0.011	57	.74-1.0	.84±0.008
F	41	.67-1.0	.84±0.013	46	.74-1.0	.84±0.009	17	.74-.94	.83±0.016

Table 1. Measurements of snout-vent lengths (SV), head widths (HW), head lengths (HL), size of tympani (HxV), eyes (E), right parotoid glands (RP), right cephalic crests (RC), and shape of tympani (H/V) of population samples of *Bufo biporcatus* from Mataram (Lombok), Klungkung (Bali) and Udjong Kulon (Java).

the horizontal dimension. No significant difference was found between the three populations. The means of these calculations are in Table 1; the range and distribution are shown graphically in Fig. 3.

4. *Shape of the tympanum.* Shape was determined by dividing the horizontal by the vertical dimension. An index of "1" represents a circular tympanum. The means of these calculations are given in Table 1; they indicate no significant difference. The range and distribution are presented graphically in Fig. 3. Although there appears to be a slightly greater incidence of circularity of the tympanum in the Mataram population, it is not significantly different from that of Klungkung or Udjung Kulon.

5. *Relation of the tympanum to the orbito-tympanic ridge.* Whether or not the orbito-tympanic ridge forms the upper boundary of the tympanum is determined by the shape of the tympanum. It was found that an elliptoid tympanum in which the vertical dimension was greater than the horizontal, came to lie closer to the ridge than did a more circular tympanum. Both elliptoid and more circular tympani were found in all three samples. This relationship is shown in Fig. 2. The animal from Mataram

	HW SV	HL SV	E SV	RP SV	RC SV
Mataram:					
males	.34	.30	.10	.17	.16
females	.33	.29	.10	.16	.15
Klungkung:					
males	.33	.29	.10	.17	.15
females	.32	.28	.09	.17	.14
Udjung Kulon					
males	.34	.29	.10	.15	.16
females	.31	.27	.09	.15	.14

Table 2. Ratios of head width (HW), head length (HL), diameter of eye (E), right parotoid gland (RP) and length of right cephalic crest (RC), to the snout-vent length (SV).

has an elliptoid tympanum lying close to the orbito-tympanic ridge; those chosen from Klungkung and Udjung Kulon have more circular tympani which are separated from the ridge.

6. *Length of cephalic crests.* No significant difference was found between the lengths of the cephalic crests of the three populations. The means of these measurements are given in Table 1; the crests are illustrated in Fig. 1.

7. *Webbing of the toes.* No significant difference was found in the webbing of the toes of the three populations. Typical examples of each population are shown in Fig. 2.

Conclusion

The examination and measurements of the three population samples of *B. biporcatus* demonstrate that no significant morphological difference exists between the three. Therefore there is no ground for separating the

animals from Lombok specifically or subspecifically from those of Java and Bali.

Measurements and examination of six specimens of *biporcatus* from Swela, Lombok, presented to the Zoological Museum in Bogor from the collection upon which Mertens ('30) based his subspecies, show no significant morphological differences from the three samples tested here, and would uphold the above conclusion.

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HARDY RAYED TORTOISE FROM BROOKLYN.—A remarkable longevity record is being set by a 368-mm, 9.7-kg female *Geochelone radiata* (Shaw), now at the Bronx Zoo. It was imported in 1931 by a relative of Mrs. George Flowers of Brooklyn, New York, and kept in the family. A household pet, the tortoise did not receive special care thought necessary for tropical reptiles. A photograph taken 25 years ago shows the animal to be about half the present size.

Mrs. Flowers, who kept the tortoise for 26 years, reports that during one of the severe New York winters it stayed close to a stove for days at a time. (On "really cold nights" she would cover it with a small blanket.) In another house, in which Mrs. Flowers lived for 24 years, it would spend the winter months in semi-hibernation because of inadequate heating. Flowers' present house, where the *radiata* was for 2 years, was thermostated at 65° F., enabling the tortoise to keep active throughout the winter.

As far as Mrs. Flowers knows, the *radiata* never suffered from a cold. Its diet included the usual vegetables and fruits; chicken skins appeared to be a taste treat. Sometimes the tortoise was seen eating dog feces, but its owner would "stop her from doing that." Ill health forced Mrs. Flowers to give the *radiata* to the zoo.

The present longevity record is superior to the captivity performances tabulated by Conant and Hudson (1949, *Herpetologica,* Vol. 5, pp. 1-8), which include a mark of 8 years 7 months from the Philadelphia Zoo and one of 9 years 9 months taken from Flower. The achievement exceeds also the somewhat inexact mark of about 20 years mentioned by Schweizer (1958, *Deutsche Aquar. u. Terr. Ztschr.,* Vol. 11, pp. 372-374, 3 figs.). The Brooklyn *radiata* survival suggests that the species is resistant to low temperatures.—*Arsene Eglis, 41-72 Denman, Elmhurst, N. Y.*

Gopherus

By CHAPMAN GRANT

The genus *Gopherus* has been separated from *Testudo* by various structural differences, habits and isolation. No generally accepted definition seems to exist at present.

Three species of *Gopherus* inhabit the southern United States and northern Mexico, but they are not clearly distinguished in the literature. Lack of data assembled from museums, the field and zoos accounts for this.

A brief summary of the divergent views of a few writers illustrates the present confusion.

True (1892) published a key to distinguish the three species of *Gopherus,* based upon comparative proportions of the feet. (The feet may vary in proportion sexually, ontogenetically or according to the method in which they were preserved in collections). True, p. 442 says: "*Chelonides* (*Testudo*) *tabulata* differs from *Xerobates* (*Gopherus*) in the absence of a nuchal.

Van Denburg (1922:987) said that *Gopherus* is "doubtfully" distinct from *Testudo.*

Bogert and Oliver (1945) speak of the "greatest diameter of the foot" in *Gopherus.* They suggest that the population of *agassizi* from the Rio Fuerte has become partially differentiated and that near Alamos, Sonora, they resemble *polyphemus* in color. On p. 399 they state that both *polyphemus* and *agassizi* lay spherical eggs, whereas *berlandieri* lays elliptical eggs. On p. 400 they state that no observations are available of *berlandieri* digging burrows.

C. L. Pope (1946 and 1955) states that very little is known about *Gopherus;* that no one has published on a large comprehensive series; that it is very closely related to *Testudo* from which it is distinguished by "extreme geographic isolation" and because it "constructs extensive burrows." (Pope apparently considers the habit of burrowing and the fact of isolation sufficient factors for separating genera). He states further that the three species of *Gopherus* are so much alike that they could be treated as three subspecies of one species; that their distinction is poorly understood; and that locality of capture, when available, should be used for classification in preference to physical proportions.

Carr (1952) distinguished *Gopherus* as "inconspicuously set off from *Testudo*" by "the more flattened fore limbs used for digging" by *Gopherus.* On page 325, ". . . *berlandieri* appears not to burrow," and page 331, *berlandieri* "digs long burrows." The "diameter" of hind foot of *agassizi* into head width, .97 and in the other 2 species in the 60's. (p. 324). (This measurement may have included the heel spines. In adults the hind foot is from 3 to 9 mm. longer than wide excluding heel spines. By "diameter" of the elliptical foot he probably referred to the long axis including heel spines.)

Loveridge and Williams (1957) state that the sole conspicuous distinction between *Testudo* and *Gopherus* is the median premaxillary ridge present in *Gopherus,* but absent in *Testudo,* a name which they restricted to the *graeca* group.

Summarizing the above: *Testudo* lacks a nuchal scute. The first marginal on each side joins its mate in a seam extending to the curve described by the remaining marginals. *Gopherus agassizi* and *polyphemus* have a nuchal scute which extends to the curve of the marginals, but it and marginals have scallops separating them at their tips. In *berlandieri* the nuchal is frequently missing, but the first marginals remain separated. When the nuchal is present it is small and does not extend to the outer line of the marginals.

The three species of *Gopherus* are separable by body shape and proportions.

Key for Adult *Gopherus*

1. Carapace height over 50 per cent of length*; nuchal missing or reduced in size, not reaching to line of marginals. ..... *berlandieri.*
2. Carpace height 45 per cent or less of length. Nuchal present.....3.
3. Body widest at midbody ..... *polyphemus.*
4. Body widest at about rear of 4th neural. ..... *agassizi.*

The nuchal of hatchling *berlandieri* appear normal, but frequently fail to develop and fall off like a scab. In old specimens the gulars may be long, forked and recurved more than other species. It apparently does not burrow and lays elliptical eggs. The heels of *polyphemus* are smooth; of *agissizi* usually spiney; both burrow and lay sperical (if somewhat warped) eggs definitely lacking a long axis.

Dr. John M. Legler (1959) described *"flavomarginatus"*, listing 3 USNM specimens, as type, 61253 and paratypes 61254 and 60976. These appear to be *polyphemus,* being widest at midbody (Legler, Pl. 7). Three more paratypes, Univ. Ill. 42953-4 and Univ. Kan. 39415 appear to be *agassizi,* being widest at 4th neural (Legler Pl. 8). He lists the holotype and 2 USNM paratypes from "30 to 40 miles from Lerdo, Durango, Mexico; obtained by Dr. Elswood Chaffee, 1918." Dr. Doris Cochran writes that these specimens were collected by Dr. August Busk and that both he and Dr. Chaffee were USNM entomologists. The specimens are mounted; one having glass eyes (see Legler Pl.7). Dr. Cochran states that they were varnished some years ago. Mr. H. H. Winters, working at the USNM as internee wrote me Aug. 11, 1959, in reply to my query as to whether the USNM specimens were not in reality *polyphemus.* "In examining the *polyphemus* in the collection, most of the *flavomarginatus* diagnostic characters can be found developed to some degree in various individuals, including the color." Mr. Charles E. Shaw, Curator of Reptiles and Mr. Jerry Staedeli of the San Diego Zoo agree with me that color is not valid for separating *polyphemus, agassizi,* and *flavomarginatus.*

Legler's "diagnosis" states that the species has a "posteriorly flared shell" (carapace). (My definition of a "flared" carapace is that the widest part is at the flare.) His remarks forces me to the conclusion that he had

*Legler's Table 2 gives mean, .46, range .43-.51 differing from those I have measured. Legler does not state his method of measuring. My measurements are the distance between verticals at anterior and posterior ends of carapace.

the latter three paratypes in mind and that he confused three specimens of *polyphemus* or a subspecies thereof with three specimens of *agassizi* or a subspecies thereof; thus describing as a new species, two forms related to two distinct species.

Legler then proceeds to a "description of the species" without describing the type and states that the carapace is "slightly more than 50 per cent of its length. . ."; *polyphemus, agassizi,* and the 3 USNM specimens are less than 50 per cent as high as long. His Tables 1 and 2 contradict his "description of the species."

If there be a population of tortoises in Durango similar to *polyphemus* it may prove to be distinct due to a feature not mentioned by Legler. The USNM specimens have the nuchal and adjoining first marginals reduced in width to the length of the straight anterior margin of the first neural. In both *agassizi* and *polyphemus* these 3 scutes occupy a wider space—usually wider than the entire first neural. The location data may be in error. The three empty carapaces, lacking plastrons, from Chihuahua and Coahuila could represent *agassizi* or a subspecies thereof. The location is not challenged.

I believe that acceptance of *"flavomarginatus"* should be delayed awaiting verification.

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RANGE EXTENSION FOR *UMA SCOPARIA* COPE.—Heretofore, *Uma scoparia* has been known only from the desert regions of Inyo, Los Angeles, Riverside, and San Bernardino Counties of California (Stebbins, 1954, Amph. and Rept. west North America, p. 226, pl. 53 [map]; Norris, 1958, Bull. American Mus. Nat. Hist., Vol. 114, pp. 280, 284). A specimen of this species was recently uncovered in the herpetological collections of the California Academy of Sciences (CAS 81478) which had been collected 15 miles SE of Parker, Yuma Co., Arizona, by J. R. Slevin, June 1, 1947. This specimen, an adult female (snout-vent length 55 mm.), appears to represent the first record for this species from Arizona.—*David W. Elvin, Assist., Dept. Herp., Calif. Acad Sci., San Francisco 18, Calif.*

FEEDING NOTES ON CAPTIVE REPTILES.—Two specimens of *Cordylus cordylus niger* from Capetown, South Africa, feed primarily on insects and worms. The lizards grasp one end of a worm and start shaking it so violently that the entire body of the lizard is affected. Immediately following the shaking, part of the worm is swallowed. If ingestion was attempted without the shaking, the worm would stretch out whenever the lizard attempted to swallow. This resulted in the worm "stretching" out of the lizard's mouth faster than it could be swallowed. When ingestion began immediately after shaking, the worm was already stretched out, and could be swallowed more easily. This shaking also occurred, although much less violently, when insects were grasped. Some chewing was evident, but to a small degree.

Gerrhonotus m. multicarinatus. A specimen from Marin Co., California, devoured a *Sceloporus undulatus tristichus* and a *Sceloporus o. occidentalis.* This specimen and one from Palmdale, California, readily accepted minnows.

Sceloporus o. occidentalis. Of ten specimens from Marin Co., California, ranging in size from about 3½ to 6 inches, placed in a cage together, four were devoured by larger cage mates.

Testudo hermanni. When placed in a bowl of water with live minnows, these predominantly herbivorous tortoises readily caught and ate the fish. All of the *T. hermanni* were small, the largest, about 85 mm.

Lampropeltis doliata triangulum. A 42⅝ inch specimen regurgitated a paritally digested 210 mm. juvenile of the same species the day after capture. The anterior portion of the regurgitated specimen was partially digested; the posterior portion showed no signs of digestion.

Leptodeira annulata. A 19¾ inch specimen ate a 2 inch *Ambystoma maculatum,* a 3 inch *Desmognathus o. ochrophaeus,* and two minnows, 36 and 40 mm. respectively.

Epicrates striatus. A six foot individual ate two *Rana clamitons melanota* over a two month period, but refused all mice offered to it.—*Phil Skehan, Jr., 624 Lake Road, Webster, New York.*

AN EXTENSION OF THE KNOWN RANGE OF *PLETHODON JORDANI METCALFI*—Nelson G. Hairston, 1951, recorded a single specimen of *Plethodon jordani metcalfi* from Haywood county, North Carolina.

On August 11 and 12, 1959, I collected two specimens of *Plethodon jordani metcalfi* in the vicinity of Balsam Mountain Campground in the Great Smokey Mountains National Park, Swain county, North Carolina at an elevation of 5,340 feet. These specimens extend the known range of this species approximately 9.5 miles west of the previously denoted range.

Both specimens measure 37.5 mm. (gular fold to anal slit)—*Stephen D. Busack, 8 Riverview Heights, Rochester 23, New York.*

The Use of Male Southern Toads and Southern Leopard Frogs for Pregnancy Diagnosis

By KEITH L. HANSEN

INTRODUCTION

Since the inception of the male anuran pregnancy test in March of 1947 (Galli-Mainini), an ever increasing number of salientia of the world have been successfully utilized as test animals for pregnancy diagnosis. In 1951 the writer reported on the positive response by a number of Florida anurans to pregnancy urine and predicted their success as test animals in the determination of early pregnancy (Hansen, 1951). Since February 1956, I have been engaged in diagnosing pregnancy for the physicians of DeLand, Florida. The southern toad (*Bufo t. terrestris*) and the southern leopard frog (*Rana pipiens sphenocephala*) have been used exclusively as test animals. The purpose of this paper is to evaluate the reliability of these two anurans as test animals for the diagnosis of early human pregnancy.

MATERIAL AND METHODS

All test animals were collected in the DeLand area, although these two subspecies may be found over the entire southeastern coastal plain. Following rains, toads were generally collected by automobile along roads bordering aquatic habitats. Leopard frogs were taken around ponds and lakes by shining their eyes with a headlight. In northern Florida, the southern toad may be collected from February through October, while leopard frogs are available throuhgout the year. Males of *Bufo t. terrestris* are easily recognized by the darkly pigmented throat. The trilling peeps emitted when handled, as well as the clasping response on one's finger, also aid in sexual determination of this species. The male leopard frog is distinguished by the enlarged, darkly pigmented copulatory (nuptial) pad on the base of the first digit of the manus. Animals were stored in the refregerator at 10°C., in gallon jars containing a trace of water.

Urine specimens were obtained from local physicians with the recommendation that they be a first morning micturition. It was further suggested that all urine be refrigerated to inhibit bacterial action and thereby avoid further toxicity. Refrigeration also aids in the preservation of the gonadotropic hormone which deteriorates at room temperature.

Centrifugation of urine for a five minute period was found to be effective in reducing death rate of test animals due to toxic urine. In the majority of cases, two animals were used in a single diagnosis to reduce the possibility of error. Depending upon the size of the animal, 3 to 5 cc. of urine was injected subcutaneously in the dorsal or lateral lymph sacs. The injected animals were then set aside in quart jars with perforated lids to await the reaction. One to three hours later, cloacal fluid was removed by capillarity with a small pipette. Cloacal fluid thus obtained was microscopically examined for spermatozoa, the presence of which indicates a positive test, or pregnancy.

Previous to injection, the cloacal fluid of each test animal was checked for sperm due to possible spontaneous emission. No sperm were ever found, even when animals had been collected from a breeding population the previous night.

RESULTS

Accuracy of Diagnosis. Of 307 pregnancy tests considered in this study, it has been possible to substantiate only 214. Of these validated cases, an accuracy of 94% was achieved using the southern toad and southern leopard frog. Of the 14 incorrect predictions, 13 were false negatives and one was a false positive. Diagnostically, the toad proved to be 95% accurate, whereas the leopard frog only attained an accuracy of 90%. The two species used concurrently were 95% correct in pregnancy prediction (Table I).

Refractory Condition in Test Animals. To minimize the possibility of error due to refractory test animals, two anurans were used. A test was considered positive when only one animal responded by the emission of sperm. In 14 instances, of the 214 validated cases, both test animals proved refractory as shown above. Of this group, incorrect diagnosis occurred using toads in 5 cases, with leopard frogs in 7 cases, and by both species in 2 cases.

In 23 cases, one of the pair of test animals proved refractory. A negative response by one anuran occurred in 11 tests where toads were used exclusively, and 7 times where leopard frogs were exclusively employed. In tests utilizing both species, the toad gave positive results in 8 cases where the leopard frog was negative. In no instance did the leopard frog give a positive response where the toad was negative.

Seasonality. A number of investigators have reported that anura are more refractory during the summer months (Samson, 1950; Berman, 1956; Hilf and Rosen, 1957). The results from the present study are in concurrence with Brody (1949) in that there was no indication of seasonal insensitivity by either species (Table II). Seasonally, the incorrect predictions were as follows: spring-15; summer-9; fall-8; winter-10.

Centrifugation of Urine. Numerous workers have reported on the death of test animals due to toxic urine. During the first few months of diagnosis, death of test animals was experienced in 14% of 111 animals receiving non-centrifuged urine. The majority of urine specimens causing difficulty were noticeably cloudy and usually were offensively odoriferous. To help negate this condition, centrifugation of urine was used to bring down extraneous materials as bacteria, urates, crystals, epithelial cells, and white blood cells. A noticeable decrease in death rate resulted (7% in 582 cases) in animals injected with centrifuged urine (Table III). There was no evidence of species viability to toxic urine by either form, the percentage of fatality in both being almost identical.

A statistical comparison of death rates between animals receiving centrifuged and non-centrifuged urine failed to show significance at the usual 5% level of confidence, although the difference was significant at the 9% level. Although a rather large sample was included in this comparison, 84% (582 cases) were in the centrifuged group whereas only 16% (111 cases) were in the non-centrifuged group. A larger number of cases in the latter group would probably provide reliable results.

Reaction Time. In the male frog pregnancy test, typically two to four hours are allowed for the reaction time. In this work, cloacal fluid was normally checked from one to three hours following urine injection. Although no attempt was specifically made to check minimal reaction time, some interesting results were obtained. In 16 instances, positive

TABLE I

Results of Tests in Pregnancy Diagnosis

Species	Number of Tests	False Negatives	False Positives	Percent Error
B. t. terrestris	98	5	..	5.1
R. p. sphenocephala	73	6	1	8.2
Both Species	43	2	..	4.7

TABLE II

Incorrect Predictions from Refractory Animals by Months

Months	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Total No. Tests Performed	26	25	13	19	19	14	27	14	16	16	13	12
Tests with one test animal refractory	2	0	5	4	3	1	5	1	3	2	2	0
Tests with both test animals refractory	1	5	2	0	1	0	0	2	0	0	1	2

TABLE III

Rate of Fatality in Test Animals Receiving Centrifuged and Non-centrifuged Urine

Species	Centrifuged Urine			Non-centrifuged Urine		
	No. Animals Reacting Normally	No. Deaths of Test Animals	Percent Fatality	No. Animals Reacting Normally	No. Deaths of Test Animals	Percent Fatality
B. t. t.	288	23	7.4	82	14	14.6
R. p. s.	250	21	7.8	13	2	13.7

TABLE IV

Case Histories Showing Early Negative Results With Later Positive Results

Probable Date of Conception	Calculated Date of First Missed Period	Negative Tests			Positive Tests		
		Date	No. Days After Con.	No. Days After M.P.	Date	No. Days After Con.	No. Days After M.P.
2-11	2-26	3-4	21	6	3-9	26	11
3-7	3-21	3-26	19	5	4-8	32	18
3-17	3-29	4-7	21	9	4-13	27	15
7-21	8-3	8-7	18	4	8-21	31	18
9-22	10-4	10-14	22	10	10-21	31	17
11-17	12-1	12-4	17	3	1-9	53	39
12-24	1-7	1-17	24	10	1-28	35	21
	Average		20	7		34	20

Abbreviations: Con.—Conception; M.P.—Missed Period

results were recorded in one hour or less. One case proved positive in 35 minutes; 3 cases in 45 minutes; 3 in 50 minutes; 2 in 55 minutes; and, 7 in 60 minutes. In this regard it should be mentioned that two cases showing negative results at 45 minutes were positive at 90 minutes. Sixty-two cases were positive between one and two hours, and only 38 positive tests were recorded after two hours. The average time for 113 positive tests was 1 hour and 50 minutes. The average time for 101 negative recations was 2 hours and 17 minutes. Reactions showing negatively at one hour, or before, were given another hour before a final check was made.

Time Limits of Pregnancy Test. Anuran pregnancy tests are based on the fact that chorionic gonadotropin of placental origin will stimulate spermiation in test animals. The test is reliable only in the early stages of pregnancy since the level of this gonadotropic hormone rises quickly following conception and falls precipitously near the end of the first trimester. The time lapse following conception before the hormone is present in sufficient quantity to evoke a positive test varies with most every case.

Brandfass and Massa (1949) cite one exceptional case in which a positive test was obtained 8 days after conception. This is an unsually early prediction and their other early cases were positive at 20 and 24 days after conception. In two reported cases, Brody (1949) obtained negative results at 18 and 25 days following conception, with later positive determinations at 39 and 30 days, respectively.

In the present study, 7 case histories showing early negative and later positive results gave further evidence for establishing a safe minimal period of time following conception for pregnancy detection (Table IV). In these cases, negative tests averaged 20 days past conception and positive test, 34 days after conception. In 4 other cases in which the first test was positive, results were obtained in 25, 29, 31, and 32 days after conception. These data would seem to indicate that a time lapse of approximately 4 to 5 weeks following conception (2 to 3 weeks after first missed period) should be allowed before diagnosis. There is real danger that a negative result obtained appreciably before these time limits might well be a false negative reaction.

DISCUSSION

Numerous species from the anuran families Pipidae, Discoglossidae, Bufonidae, Leptodactylidae, Hylidae, Ranidae, and Microhylidae have been successfully utilized as pregnancy test animals. Species from the genus *Bufo* and *Rana* have been used preponderantly. Two additional forms from these genera, not previously used in pregnancy detection, are recommended; namely, *Bufo t. terrestris* and *Rana pipiens sphenocephala.* It is rather surprising that such limited use has been made of North American anuran species as laboratory animals in pregnancy determination. Although every biotic province of temperate North America has representative species from the two above genera, the northern leopard frog (*Rama p. pipiens*) has been used almost exclusively. Possibly the ease of ordering from biological supply houses coupled with a general apathy by many toward natural history accounts for this fact. The physician or medical technician, even if not personally interested, could stimulate youthful naturalists to cheaply supply local anura. The problem of obtaining salientia during the colder months in northern states is recognized.

A cyclic condition has been shown to exist in the gonads of some of the northern anura. A gradual hypertrophy of the gonads through the fall and winter culminate in full mature organs ready for the spring breeding. Following the breeding period, the gonads remain hypotrophied through the summer months. This cycle is seemingly reflected in a larger number of false negative tests during the summer months for the northern leopard frog. The fact that no seasonal refractoriness was evident in this work is interesting in the light of the reports of seasonal insensitivity with *Rana p. pipiens*. It appears that seasonality is not as pronounced in the reproductive physiology of some of the southern forms as in the northern species. Einem and Ober (1956) point out that, "The mild climate of the Florida peninsula affords salientia a prolonged activity period reflected by, among other traits, their extended breeding and shortened 'hibernating' cycles." These workers reported *Bufo t. terrestris* breeding as early as May and as late as October. My own records show a breeding chorus of southern toads on the night of February 23, 1955 near Gainesville, Florida. Wright and Wright (1949) state that the breeding season for the American toad (*Bufo terrestris americanus*) extends from April 5 until July 25. Concerning leopard frogs, Rugh (1948) listed *R. p. pipiens* as breeding from Apr. 1 to May 15 and *R. p. sphenocephala* from Feb. to Dec. He further mentioned that in the former, induced breeding is successful from Sept. 1 to May 1, whereas in the latter it is possible all year. Thus, the prolonged reproductive potential of the southern toad and southern leopard frog may explain their lack of summer refractoriness in pregnancy diagnosis.

Robbins (1948) stated that the male frog test will detect pregnancy approximately 7 days after the first missed period, i.e., about 21 days after conception. Marsters, *et al.* (1950) reported that 7 of their earlier reactions occurred about one week past the first missed period. They further mentioned, however, that 13 of their early tests showing negative reactions were repeated later with positive results. The present work showed that at least 6 of the 13 false negatives were premature attempts, in that positive results were obtained approximately two weeks later. Interestingly, these 6 premature cases came from personal friends whose anxiety, it would seem, overcame the natural hesitancy of presenting a urine specimen to the physican for pregnancy diagnosis. Although positive responses are obtained as early as 7 days past the first missed period, this is probably early if a safe time period is desired. For more reliable diagnosis, a period of 4 to 5 weeks past conception or 2 to 3 weeks past the first missed period is recommended.

Of the two test animals used in this work, the southern toad was considered somewhat superior to the southern leopard frog. The toad was found to be 4.5% more accurate in over-all diagnosis. In addition, this subspecies was found to hold up better in the laboratory under refrigerated storage. Further, toads are much easier to handle when injecting and obtaining cloacal fluid due to their docile nature and comparatively poor jumping ability. McCallin and Whitehead (1949) obtained excellent results using the northern race (*B. t. americanus*) of this species in pregnancy diagnosis. It is therefore recommended that physicians and medical technologists throughout the eastern United States utilize the species *Bufo terrestris* as a laboratory animal.

The use of two test animals seems warranted in the light of 23 incorrect predictions from one animal of a pair. Had only one animal been used in these 23 cases, one might expect by chance that approximately half would have been incorrect. This alone would have increased the percentage of error by 5%.

SUMMARY

1. The southern toad (*Bufo t. terrestris*) and the southern leopard frog (*Rana pipiens sphenocephala*) have been successfully used for the diagnosis of early human pregnancy and are recommended as reliable test animals.
2. In 214 validated cases, an accuracy of 94% was achieved. Diagnostically, the toad proved 95% accurate, the leopard frog 90% accurate. Both forms used concurrently were 95% correct.
3. The use of two test animals for each test seems warranted, since refractory animals were found in 11% of the total number of cases.
4. No trend of seasonal insensitivity was found in either species.
5. Death rate in test animals due to toxic urine was reduced from 14% to 7% by 5 minute centrifugation of urine specimens.
6. A period of 4-5 weeks following conception (2-3 weeks after the first missed period) is recommended as minimal before attempting accurate pregnancy diagnosis.
7. The average reaction time for 113 positive tests was one hour and 50 minutes; for 101 negative reactions, two hours and 17 minutes. Of the positive tests 16 were established in one hour or less, while 62 reacted between one and two hours.
8. It is recommended that local species of *Bufo* and *Rana* from biotic provinces of temperate North America be used as test animals for pregnancy diagnosis.
9. As a test animal, the southern toad was found to be somewhat superior to the southern leopard frog.

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ON A BROOD OF *SISTRURUS* FROM NORTHERN INDIANA. —On July 11, 1959, an adult *Sistrurus c. catenatus* (K. K. Adler 187), 23¾ inches in total length (t-l), was collected by the author 2½ miles west of Culver, Marshall Co., Ind., near Ind. Route 10.

On August 14, 1959, she bore seven young (KKA 183, A-G). The first was dropped at 3:10 p.m. (C.D.S.T.) and remained upside-down in its sac until it was broken open at 5:15 p.m. The others broke their sacs within a short time after birth. The last young was malformed and born dead at 5:05 p.m. At 6:30 p.m. the mother was very irritable, striking for the first time since capture and rattling continuously.

By 6:30 p.m. the first young had dried and started to examine its enclosure. A young "pink" mouse was placed nearby at 7:00 p.m. and was promptly bitten twice. At 7:05, the mouse was again struck three times. Although the mouse was still alive at 10:00 p.m., it was found dead the next morning at 5:20 a.m. and was stiff, indicating death several hours previous. By 8:00 p.m. of the 14th, all of the young were dry and explored the cage. All would attempt to rattle their yellowish-white tail and would strike at any moving object. In contrast, the mother was now quiet and remained neatly coiled in one corner of another cage to which she had been transferred.

At 9:30 a.m. on the 15th, a water dish was placed in the cage to aid the shedding. One young had devoured a dead "pink" mouse during the night. Four shed skins were removed at 8:00 a.m., August 18; these had not been shed by 10:00 p.m. of the previous day. One more was shed by 7:00 p.m. the 18th, and the last by 8:00 a.m. on the 21st. The young were very dark blackish, velvety in appearance, and considerably darker than their brownish mother.

The dead individual measured 6½ inches t-l. The other living examples average large for *Sistrurus;* 9½, 9¾, 9 15/16, 10, 10, and 10 1/16 inches (Average 9 9/10 inches, t-l); exceeding those reported in Conant: *Field Guide,* 1958, p. 188; and Wright & Wright: *Handbook of Snakes,* 1957, p. 1046. Swanson (*Copeia,* 1933(1):37), however, lists slightly larger specimens.—*Kraig K. Adler, 2370 Club Road, Columbus 21, Ohio.*

of Snakes, 1957, p. 1046. B. A. Wright (*Amer. Midl. Nat.* 25(3): 666 1941), however, lists slightly larger specimens.—*Kraig K. Adler, 2370 Club Road, Columbus 21, Ohio.*

HERPETOZOA* FROM JALISCO, MEXICO.—April 22-28, and June 25-July 3, 1950, the senior author collected about 400 specimens of 33 species of amphibians and reptiles, all donated to the University of Illinois Museum of Natural History (UIMNH), in the vicinity of Guadalajara, 5000 feet, Jalisco. Localities include the upper edge of the Barranca de Oblato at the edge of the city; Mascota, el. 3500 ft.; Rancho Primavera, 10 mi. W of Guadalajara on the road to Nogales; Buena Vista, 40-50 mi. S Ixtlahuacán; and Mt. Tequila. Some of the material is of special interest for variational and life history data. The rest includes *Rana megapoda* (1), *R. pipiens* (1), *Bufo occidentalis* (3), *Kinosternon integrum* (1) and *Leptodeira septentrionalis polysticta* (1) from Mascota; *Diadophis dugesi* (1) and *Masticophis s. striolatus* (1) from Rancho Primavera; *Ctenosaura pectinata* (3) from Barranca de Oblato; *Spea hammondi multiplicata* (2), *B. occidentalis* (24), *B. c. compactilis* (2), *Leptodactylus melanonotus* (2), *Eleutherodactylus occidentalis* (5), *Tomodactylus nitidus petersi* (1), *Hyla arenicolor* (3), *Rana megapoda* (34), *R. pipiens* (53), *Sceloporus heterolepis* (18), *Ctenosaura pectinata* (1), *Masticophis s. striolatus* (1), *Oxybelis aeneus auratus* (1), *Hypsiglena t. torquata* (1), and *Diadophis dugesi* (1), all from Rancho Primavera; and *Lampropeltis triangulum nelsoni* (1), and *Masticophis s. striolatus* (1), Buena Vista.

Hyla eximia Baird. Rancho Primavera, 1 ad. ♀, July. Gorged with eggs, 26 mm. s-v, and having a tympanum with its edge scarcely raised, this specimen might be construed to represent *Hyla microeximia* Maslin. The choanae are about twice the size of a prevomerine boss, but so also are they in one paratype of *microeximia*. The latter species poses a difficult problem. None of the well-represented populations of this group included in the UIMNH collections from Jalisco, Durango and Nayarit can with confidence be allocated with that species. Certain individuals resemble described specimens of *microeximia*. In addition, small choanae, low tympanum and small size occur in specimens from widely scattered parts in the range of *eximia*, although no *population* has been detected with such a small size as that of *microeximia*. Individually, at any rate, no characters save possibly voice and size are distinctive of *microeximia*. It is not evident that the latter species, if valid, is widely distributed, even in the Jalisco-Nayarit area; it certainly is not a geographic race, for typical *eximia* occurs throughout the area. If valid at all, *microeximia* is a cryptic species. Validity in this sense remains a question that can be settled only with further field work. It may be noted that voice- and size-variants are well known in certain much better studied anurans of the U. S., and that such characters have not there been shown always to be correlated with taxonomically valid

*An acceptable English collective for the words reptiles and amphibians has been elusive. The terms herps, herptiles, herpesian, and rephibia have been suggested in recent years, but all have serious etymological drawbacks. Mr. M. B. Mittleman has suggested still another term, *herpetozoa*, and has given us permission to introduce it for him. Its etymology is wholly appropriate, in the sense that has become familiar through acceptance of the term herpetology: *herpes, herpeto-*, G., a creeping or crawling thing, and *zoa*, G., animals. The adjectival form of herpetozoa (sing., herpetozoon) is herpetozoan, which is highly preferable in most contexts to the term "herpetological," *e.g.* herpetozoan collections rather than herpetological collections.

cryptic species lacking other differentiae. *H. microeximia* may well prove to be just such a micropopulation.

Phyllodactylus lanei Smith. One, lower slopes of Mt. Tequila, forepart of body missing. The caudal and corporal tubercles are typical. No definite locality has previously been recorded for the species in Jalisco.

Anolis nebulosus (Wiegmann). Barranca de Oblato, 1; Rancho Primavera, 16; Mt. Tequila, 1. The combination of dorsal scales markedly smaller than ventrals (but both relatively small) and absolutely smooth dorsal head scales identify these examples as *nebulosus;* in *nebuloides* the dorsal scales are but slightly smaller than ventrals (and both are relatively large), and the dorsal head scales are rugose or keeled.

Sceloporus bulleri Boulenger. Mascota, 23. In addition the UIMNH possesses 5 other specimens providing new locality records, including the second from Sinaloa: 37 mi. E Concordia, Sin. (41621-2), and Km. 109 on the Autlán Road, Jalisco (37936-8). The largest male is 113 mm s-v, the largest female 107 mm. It has not been noted previously that the females possess ventral markings much like those of males, but less intense; the largest females, however, are very similar to males: the central gular area is a bright blue, the sides of abdomen blue with black median borders almost meeting medially. I am not aware that any other species of the *torquatus* group, save *dugesi,* is so similarly marked on the belly in the two sexes.

In the series at hand, dorsals 36-41 (36, 1; 37, 2; 38, 5; 39, 4; 40, 6; 41, 3); femoral pores 14-19 (14, 2; 15, 5; 16, 13; 17, 7; 18, 5; 19, 2); supraoculars variable, one or more subdivided into a smaller lateral and larger medial scale in about 2/3 of specimens; collar showing tendency toward medial obsolescence in a few specimens.

Most females observed were carrying nearly full-term young. Some had just given birth, as some juveniles were observed (30-40 mm. s-v). Two specimens contained 5 and 7 young, thought to be a full complement for each individual.

Sceloporus d. dugesi Bocourt. Buena Vista, 10. Young of the year in late June are 38 mm. s-v., and accordingly had been born a few weeks earlier.

Sceloporus heterolepis Boulenger. A fine series of 18, Rancho Primavera, early July. Numerous young are included, 26-31 mm. s-v, suggesting that the young are born in June. Superficially similar is *S. shannonorum* Langebartel, but details of scutellation differ markedly; a very conspicuous difference, constant in *heterolepis,* involves the very small median dorsal nuchals bordered on each side by a longitudinal row of large scales in *heterolepis,* whereas in *shannonorum* the dorsal nuchals are uniform in size and shape as in most other species of the genus. Femoral pores 14-19 in five adults (mean 17.5).

Sceloporus horridus albiventris Smith. Barranco de Oblato, 5; Rancho Primavera, 14. Seven are males, as indicated by size of enlarged postanals, but 3 of the 6 adults lack any ventral coloration that would distinguish them from females. Four have distinct gular bars and a grill-like, slight bluish cast at sides of abdomen.

Sceloporus scalaris unicanthalis Smith. Rancho Primavera, 34. This

fine series confirms the distinctness of this race. All specimens have one canthal on both sides except for one with two canthals (the anterior one above the canthal ridge) on one side. Males have bluish areas, without transverse black lines as in *s. scalaris,* but no blue in the gular area, which in turn is not boldly barred as in *s. scalaris,* and only in 4 is it clearly barred. The ventral blue color is thus much less extensive and the leg is longer than in the very similar *aeneus subniger* of the central plateau region. The average size is greater than that of *subniger,* as all but 4 are 50 mm. s-v or more, one reaching 59 mm. s-v. Yet the differences between this and related forms are not especially sharp; a definitive analysis of relationships of this group remains to be made.

July females have well-developed eggs. One male is strikingly different from all others in having a conspicuous, broad, reddish orange band from axilla to groin, lateral to the belly patches.

Sceloporus torquatus melanogaster Cope. Barranca de Oblato, 17; Buena Vista, 18. Most adult females (April) were carrying nearly full-term young, some had already given birth, and a few recently born juveniles were seen. In late July the young had reached 45 mm. s-v. The local population has the characteristic obsolescence of the nuchal collar in broad middorsal zone, one row of supraoculars and large dorsals. The occurrence of three distinct species of the *torquatus* group in one area as small as that sampled by this collection is highly unusual.

Urosaurus b. bicarinatus (Duméril). Barranca de Oblato, 9; Rancho Primavera, 3. Males have the abdominal blue spread from gular fold posteriorly to arms; the central gular area is light pink in two, yellow in four, orange in one. In the 9 females the abdominal blue is spread from gular fold or mid-sternum to groin, not invading the preanal area; the central gular area is white or pale yellow in 4, bright yellow in one.

Geographically these specimens should be *tuberculatus,* but the strongly keeled dorsals and ventrals, extensive ventral blue and prominent rugosity allocate them with *bicarinatus.* A review of geographic variation in the species is much needed.

Cnemidophorus sacki scalaris Cope x *C. s. huico* Zweifel. To "typical" *scalaris* are referred 11 from Rancho Primavera. All are mature, the largest measuring 101 mm. s-v. Females possess large eggs seemingly ready to be laid. These specimens are thought to be more or less typical of *scalaris* in this region since the pattern agrees excellently with Zweifel's figure (1959, Bull. Amer. Mus. Nat. Hist., 117: pl. 48) of a specimen from 10 mi. N Chapala, Jalisco; all except one with two vertebral light stripes; postantebrachials sharply enlarged; two transverse rows of small postgulars (between anterior gular fold and anterior gulars, G and E respectively, of fig. 4 of Burt., 1931, Bull. U. S. Nat. Mus., 154: 24); throat with a grayish suffusion; dorsal light stripes persistent in all except one mature male; scales around middle of body (one side only) 44-56, mean 49.0. Even this "typical" lot has more dorsals than Zweifel records for the species, although he was aware that southern specimens have smaller scales than northern ones.

Also from Rancho Primavera is one specimen more or less typical of Zweifel's *Cnemidophorus sacki huico.* It is a mature male with stripes nearly obsolete, replaced by rows of spots; postantebrachials small; only

one transverse row of small postgulars; throat pink, not at all gray-suffused; scales around midbody on one side 43. This specimen agrees excellently with *huico* except in the low dorsal scale count, and in having two vertebral light lines.

The Rancho Primavera population seemingly represents predominantly *scalaris,* with at least some indication of blending with *huico,* as indicated by the high scale counts, obsolescence of stripes in some, and union of the vertebral stripes in some. Although this particular sample could well be divided into two parts, one assigned to *C. scalaris* and one to *C. s. huico,* following Zweifel, another sample from Barranca de Oblato shows that this is impractical and that all the populations of this area are of intergrade nature.

From Barranca de Oblato are two specimens (46680-1) closely resembling "typical" *scalaris,* having the same pattern, ventral color and scutellation as the Rancho Primavera *"scalaris"* (dorsals on one side 43,50); 22 resembling "typical" *huico* (46650-1, 46653-6, 46658, 46660-2, 46664-8, 466670-1, 46673-4, 46676, 46678-9), most immatures having a single vertebral light stripe, stripes completely replaced by spots in largest males, dorsals on one side 39-51, mean 45.0, max. length 86 mm. s-v, and other characters as in the single Rancho Primavera *"huico";* and nine (46649, 46652, 46657, 46659, 46663, 46669, 46672, 46675, 46677) that are intermediate, having moderately enlarged postantebrachials, either a single or double vertebral stripe, postgulars with one or two transverse rows of small scales, and dorsals 41-49, mean 46.1.

The Barranca de Oblato sample, presumably because of its larger size, simply does not sort out into well-defined groups. Two groups corresponding with *huico* and *scalaris* can be recognized, but they blend with each other through intermediates. The Oblato population is, therefore, here regarded as an intergrade population, with a predominance of characteristics of *huico.*

It seems likely that characteristics of *huico* increase in preponderance toward the deep valleys leading into the plateau from the coast, and that they diminish sharply on the plateau away from these areas of introgression.

The absence of specimens resembling Zweifel's *C. sacki occidentalis* in both of the present samples is somewhat surprising. Differences in seasonal occurrence might account for this discrepancy, although it is not likely. That might also account for difference in abundance of the *scalaris* type at Rancho Primavera (July) and Barranca de Oblato (April), for certainty *sacki* and *gigas* differ very strongly in seasonal abundance in Guerrero. The difference is probably *not* seasonal, but in *Cnemidophorus* nothing can be ruled out as impossible.

Thamnophis eques eques (Reuss) x *T. e. megalops* (Kennicott). Rancho Primavera, 4, and hyacinth-choked lagoon betw. Guadalajara and airport, 15; Buena Vista, 1. Relatively little can be added to the already voluminous literature on variation in this species. In all, the median stripe involves at least 3 scale rows (covering all or most of the paravertebral rows), and in a few involves 5 rows; chin-throat region bright yellow, subcaudal-anal region pink, both areas in sharp contrast with slate belly (less vividly in a specimen preparing to moult); no red

in dorsal or lateral pattern. First preanal scale divided in two specimens; loreals 2-2 in one, 1-1 in others; supralabials 8-9 in one (with 5-6 entering orbit), 9-9 in two (5-6 entering orbit), 8-8 in others (4-5 entering orbit); ventrals 155-164 ♀ (155, one; 156, two; 157, one; 158, one; 160, three; 161, two; 164, one), 161-169 ♂ (161, one; 165, one; 166, one; 167, two; 168, one; 169, one); caudals 65-79 ♀ (65, one; 68, one; 70, one; 77, one; 79, one), 80-85 ♂ (80, three; 81, one; 85, one). The pattern best fits that of *e. eques*, but the caudal counts are intermediate and include extremes not found in typical *e. eques* but none exceptional to *e. megalops*. As indicated elsewhere (Smith, 1942, Zoologica, 27:115), specimens from this area are best interpreted as intergrades between *eques* and *megalops*.

Thamnophis melanogaster canescens Smith. Hyacinth-choked lagoon betw. Guadalajara and airport, 10; Rancho Primavera, 1; Buena Vista, 1. The first are nearly topotypes, since the type locality is Chapala (outskirts of village). They agree, in general, with the diagnosis given in conjunction with the description of *T. m. linearis* (Smith, Nixon and Smith, 1950, Journ. Linn. Soc. London, 51:576); variation of interest includes: preoculars 2-3 in one, 2-2 in eight; caudals in males 60, 67(2), 68, in females 55, 57(2), 58(2); 2nd labial in contact with nasal on one side in one, both sides in one, on neither side in 8; max. s-v ♂ 330 mm., ♀ 380 mm.; ♂ ♂ with knobby keels on scales at side of and preceding vent; a half ventral preceding vent in one; lateral light line not evident in one, barely evident in 3, dim in 2, prominent in 4; belly dark slate to light slate, underside of head and neck yellowish, anal and preanal pink in life. - *Chapman Grant and Hobart M. Smith, Route 1, Box 80, Escondido, California, and Dept. Zoology and Museum of Natural History, Univ. Illinois, Urbana.*

TOAD POISONING IN A LIZARD.—A large adult *Lacerta lepida* (19 inches total length; 8 inches body length) was placed in an outdoor pen with several other reptiles and amphibians. While the lizard was sunning, it was startled as an adult *Bufo horribilis*, collected in late August, 1959 at Navajoa, Sonora, Mexico, walked toward it. As the toad brushed against the lizard, the lizard bit the toad on one of its parotoid glands. The lizard immediately released its hold. For about one minute the lizard moved around shaking its head and opening and closing its mouth. After this the lizard held its mouth open with its tongue twisted and hanging out of one side of its mouth. The majority of the toad's secretion was washed out of the lizard's mouth. It could be easily seen sticking to the upper and lower jaws and among the teeth of the lizard. Although all the poison that could be seen was washed from its mouth within five minutes, the lizard became relaxed, its eyes became glassy and it would not move unless poked, although it held its head partly erect. Within ten minutes the lizard appeared unconscious with its head, legs and body limp. When rolled on its back it made no motions. It continued breathing for about ten minutes longer before it died.—*T. J. Papenfuss, 423 Boynton Ave., Berkeley, California.*

NORTHERN OCCURRENCE OF THE WESTERN PATCH-NOSED SNAKE.—On May 14, 1959, a female *Salvadora hexalepis* (body 461 mm., tail 141 mm., ventrals 197, and caudals 85) was taken immediately north of the Cuyama River just inside San Luis Obispo Co., Calif. The site is due south of Double Springs, approximately 20 miles ENE of the center of Santa Maria, Santa Barbara Co. This record is essentially equidistant from the known ranges of two subspecies of this snake, *virgultea* in the Coast Ranges to the south, and *mojavensis* in the Great Valley to the east. The coastal extension would be 50-80 miles northwest of Henley's Camp on Sespe Creek, Ventura Co. (Bogert, 1939, Publ. Univ. Calif. Los Angeles Biol. Sci., 1:177-236.) and the valley extension would be 65 miles west of either Bakersfield or Grapevine Station, Kern Co. (Bogert, 1945, Amer. Mus. Novitates, 1285:1-14.) The distance along the coast is indefinite because Henley's Camp could not be located on conventional maps. Henley's Camp might not be the northernmost coastal record—Perkins (1949, Bull. Zool. Soc. San Diego) implied a Santa Barbara Co. *virgultea* record but gave no locality.

According to habitat data, the animal could belong to either subspecies. The vegetation at the site of capture is typified by an admixture of desert shrubs, usually occurring singly and, although scattered, at about ten feet intervals. Allscale, *Atriplex polycarpa,* is the dominant shrub. In the intervening areas the sandy soil is covered by sparse herbaceous vegetation and scattered rocks. The snake was encountered in the herbaceous area. After a hasty retreat, the reptile stopped next to a shrub, where it was shot by Karl Bell, a student of our college.

Morphologically, the snake conforms closest to Bogert's designation of *virgultea.* It agrees in pattern and in one left supralabial meeting the eye (fifth supralabial instead of typical sixth). However, the lack of any such meeting on the right side (the suboculars form a complete ring under the right eye) is indicative of *mojavensis.* In spite of this inconsistency, the specimen was found in the Coast Ranges and the color pattern is typical of *S. h. virgultea* (Bogert), the coast patch-nosed snake. —*Richard A. Pimentel, Biological Sciences Department, California State Polytechnic College, San Luis Obispo, California.*

OPHIOPHAGY IN *SCELOPORUS.*—Smith, 1946, records "insects, spiders, millipedes, pseudoscorpions, and probably other kinds of invertebrates" and Ditmars, 1936, lists soft-bodied insects as food.

On June 1, 1959, a *Storeria occipitomaculata occipitomaculata* was placed in a cage containing a *Sceloporus undulatus undulatus.* Several minutes later the *Sceloporus* seized the *Storeria* at mid-body and ingested it "doubled over". The *Sceloporus* measured 75 mm. (s-v) and the *Storeria* measured 150 mm. (Total). —*Stephen D. Busack,* 8 *Riverview Heights, Rochester* 23, *New York.*

Distribution of *Pseudacris nigrita nigrita* and *Pseudacris nigrita feriarum* in the Piedmont and Coastal Plain Regions of North Carolina[1]

By BILLY S. BATTS

This study was undertaken to determine the range of the chorus frogs, *Pseudacris nigrita nigrita* and *Pseudacris nigrita feriarum* in the Piedmont and Coastal Plain regions of North Carolina. Wright and Wright (1949) record the distribution of *nigrita* in the lower coastal plain, with *feriarum* limited to the middle coastal plain and westward to the foothills. There is indication of intergradation in Martin, Beaufort and Pitt Counties. Brimley (1939-43) states that *nigrita* has been reported from Beaufort, Columbus, Craven, Edgecombe, Pitt and Wilson Counties, and that *feriarum* has been reported from Wake, Halifax, Orange, Durham, Vance and Guilford Counties. Schwartz (1957) records *nigrita* from Carteret, Brunswick, Jones, Scotland and Richmond Counties and *feriarum* from Orange and Richmond Counties.

Collections of *nigrita* and *feriarum* were made from February 19 through April 6, 1956. Other specimens in the collection at North Carolina State College, Raleigh, North Carolina, were used. These had been collected from 1939 to May 1956. Also, specimens from the Elon College Collection, Elon College, North Carolina, were examined. The author has examined specimens of *nigrita* from Beaufort, Bladen, Craven, Nash, New Hanover, Pitt, Washington and Wilson Counties. Specimens of *feriarum* have been examined from Alamance, Bladen, Chatham, Edgecombe, Franklin, Guilford, Johnston, Martin, Nash, Orange, Pitt, Wake and Wayne Counties; a total of over 200 specimens.

It was found that *feriarum* had a range as far east as the division between the upper and lower coastal plains, whereas *nigrita* had a western range up to the division between the upper coastal plain and the piedmont (Fig. 1). The western range of *nigrita* differs from that indicated by Wright and Wright, and Brimley. An east-west range of approximately 70 miles along the lower coastal plain was indicated by the above authors, whereas it was found that the western range was approximately 240 miles from the coast at the widest point. The records of *nigrita* by Schwartz in Richmond and Scotland Counties are at the southwestern corner of the upper coastal plain, yet still within the area in which it is expected. Wright and Wright, and Brimley do not record *nigrita* north of Albemarle Sound and east of the Chowan River. There are no specimens of *nigrita* from this area in the collections examined. The author has no knowledge of any attempts which have been made to collect *nigrita* in the area mentioned.

Wright and Wright, in their distribution map of *feriarum* and *nigrita*, indicated a small overlap at the division of the upper and lower coastal plain. Smith and Smith (1952) indicated that *nigrita* replaces *feriarum* at about the fall line from central North Carolina southward. Schwartz found an overlap of 20 miles in the distribution of *nigrita* and *feriarum* in South Carolina. Carr and Goin (1955) found that *feriarum* not only occurs in the piedmont, but also extends into the coastal plain on the Gulf coast

[1]Submitted for publication December 7, 1959.

along the Apalachicola River Valley. The amount of overlap, i.e., the entire upper coastal plain, differs considerably from that indicated by Wright and Wright. Instead of a small overlap, one of 50 to 100 miles was found.

Neill (1949) considered that the *nigrita-feriarum* complex intergrades in South Carolina and Georgia along the piedmont-coastal plain fall line; whereas Schwartz doubts that integradation occurs, since he could find no intergrades between *nigrita* and *feriarum* in the fall line area of South Carolina. Schwartz regards *feriarum* as a subspecies of *triseriata,* not *nigrita.* Carr and Goin, studying *nigrita* and *feriarum* in western Florida, felt that *feriarum* and *nigrita* should be given full specific rank. Carr (1940) found that the *nigrita-feriarum* complex overlaps in Florida and does not intergrade. Thus he has given *nigrita* and *feriarum* specific rank. It was found that all specimens could be assigned to *nigrita* or *feriarum* without difficulty and none that could be considered intergrades was noted, thus indicating that intergradation does not occur in North Carolina. The accessibility of *nigrita* to *feriarum* and vice versa is much greater in North Carolina than in South Carolina and therefore the opportunity

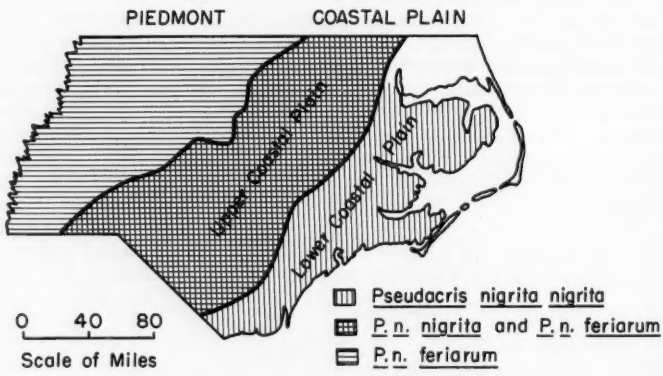

Figure 1. Regions where Pseudacris nigrita nigrita and Pseudacris nigrita feriarum are found in North Carolina, showing the amount of overlap, not intergradation.

for intergradation is much greater. That this supposed intergradation does not occur is indicated by the fact that no intergrades were found.

Schwartz mentions taking *nigrita* and *feriarum*-like individuals only once in the same locality. Among the specimens examined three instances were noted where both *nigrita* and *feriarum* were taken in the same locality at the same time: in Nash, Bladen, and at the junction of Nash, Johnston and Franklin Counties. In Nash County seven were taken March 14, 1956; two were *nigrita* and the other five were *feriarum.* Both *nigrita*

and *feriarum* were represented from Bladen County (5 miles northwest of Acme), February 19, 1956. *P. n. nigrita* and *feriarum* were not observed breeding in the same locality at the same time. Thus, the author is in accord with Schwartz and Carr that *feriarum* should not be regarded as a subspecies of *P. nigrita,* at least in North Carolina. It appears that Schwartz's classification of *feriarum* as a subspecies of *triseriata* is feasible since Smith and Smith have shown that *P. n. feriarum* intergrades with *P. n. triseriata* in the central Mississippi region.

In summary, the results show that only *nigrita* may be found in the lower coastal plain. Both *nigrita* and *feriarum* occur in the upper coastal plain, but no intergrades have been found. Only *feriarum* occurs in the piedmont.

The author wishes to thank Dr. B. B. Brandt, Professor Emeritus of Zoology, North Carolina State College, Raleigh, North Carolina, for assistance and encouragement. Many thanks are due Mr. Mac Preddy, Franklinton, North Carolina, for assistance in the field.

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RECORD CLUTCH OF *LAMPROPELTIS* EGGS.—On June 22, 1959, a large *Lampropeltis calligaster calligaster* which had been in my collection since June 9, 1959 laid a clutch of seventeen eggs. The *Field Book of Snakes* by Schmidt and Davis listed the maximum number of eggs for this species as eleven. Wright and Wright in their *Handbook of Snakes* record the maximum as thirteen, and Carpenter (1958:115) mentioned two records of fourteen in Herpetologica. This then constitutes a new record for the species. —*Sylvester E. Dietrich, Gerald, Mo.*

DESCRIPTION OF THE EGGS OF *BUFO BOREAS EXSUL*.—In the original description of *Bufo boreas exsul* Myers (Occ. Pap. Mus. Zool., Univ. Mich., 1942 (460):1-13) no mention was made of the eggs or larvae. Subsequently, Wright (Hdbk. Frogs and Toads, 1949:84 and 179) and Stebbins (Amphs. of West. No. Amer. 1951:241-242) have given descriptions of the larvae, but did not examine the eggs.

On 22 March 1959 I obtained eggs as well as adults in the fresh water spring-fed streams at the type locality, about ¼ mile south of Deep Springs Lake, Inyo Co., Cal. Many streams and ponds with a high alkali and sulfur content contained no toads. Like *Bufo canorus,* these toads are diurnal, becoming much more active as the day progresses.

Eggs were deposited in strings mainly within a 12 by 14 inch area with some strands extending 12 to 18 inches from the main mass. The strings were entwined among grasses and water cress from the surface to about four inches in water that was six to eight inches deep. In all cases the deposition was near the edge of the stream in quiet water. Superficially the strings resemble those of *Bufo boreas halophilus* in manner of deposition

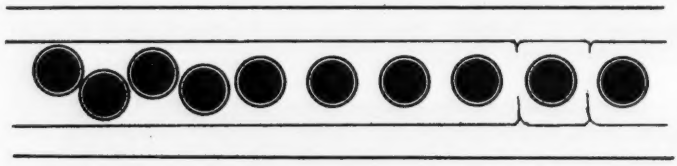

Fig. 1. Composite illustration of *Bufo boreas exsul* eggs, showing incomplete partitions, normal linear series and close zig-zag arrangement. 4x

and in that the vitelli are often in a zig-zag within the strand, although not nearly so closely apposed. However, the area covered by the mass was not so extensive nor laid at as great a depth. Egg masses of *exsul* present a more bunched appearance.

Measurements (in millimeters) in the late blastula stage: diameter of vitellus 1.49 to 1.75 av. 1.62; vitelline capsule 1.69 to 1.95, av. 1.82 (leaving an obvious peri-vitelline space); inner envelope 2.70 to 3.77, av. 3.1; outer envelope 4.48 to 6.63, av. 5.73. Surface of outer envelope was moderately loose and viscous, picking up debris, and was easily separable from the inner envelope. Vitelli per inch from 8 to 14, average 12 in single linear series and 15 to 20, av. 17 in zig-zag series. Vitelli were jet black above shading to gray or creamy-buff below. Frequently incomplete partitions, formed by the inner envelope, were noted between succeeding vitelli (Fig. 1).

In a comparison of *exsul* eggs with *boreas* and *halophilus* (Livezey and Wright, Amer. Midl. Nat., 1947, 37(1):179-222) several differences become apparent. Vitelli of *exsul* tend to be smaller, more closely approximating *boreas* than *halophilus,* however, there are fewer vitelli per inch than with either of the other forms. With *exsul* the inner envelope is smaller, but the outer envelope is larger and more viscous. Only with *exsul* is there a tendency toward the formation of intervitelline partitions.—*Robert L. Livezey, Sacramento State College, Sacramento, Cal.*

Criteria for Determining Sex and Breeding Maturity in Snakes

By HENRY S. FITCH

A simple method for determining sex in living snakes was described by Blanchard and Finster (Ecology 14: 334-347); a blunt probe is inserted through the anal orifice and directed posteriorly. If the snake is a male, the probe can be inserted into the tail through the invaginated hemipenis on either side, usually for a distance of from one-fourth inch to more than an inch, depending on the size of the individual and the species involved. In the female the probe cannot be inserted an appreciable distance without rupturing the wall of the cloaca and the connective tissue of the tail. Blanchard (Bull. Antivenin Inst. Am., 4:95-104) also described secondary sexual differences in various kinds of common snakes. Ordinarily the relative tail length is noticeably greater in the male. This difference is correlated with the fact that the hemipenes with their attached muscles and tendons are lodged in the tail. Difference in shape of the tail is also noticeable; in the female the diameter of the tail near its base is much less than the diameter of the body immediately anterior to the anus, while in the male the base of the tail is somewhat swollen because of the hemipenes, and the tail may equal or even slightly exceed in diameter the adjacent part of the body. In certain snakes, notably the natricines, various scales in the adult male are modified as an adaptation to courtship behavior—there are keels, sometimes knobbed, on the scales of the anal region, which are used to stimulate the female, and there are sensory pits in the chin shields. Blanchard suggested that development of these structures might be indicative of breeding condition. However, insofar as known, the structures appear at about the time sexual maturity is attained and are retained subsequently throughout the remainder of the individual's lifetime including those parts of the annual cycle when the snake is sexually quiescent. The structures become more prominent as the individual grows older.

In most kinds of snakes sexual dimorphism in color pattern either is absent altogether or is but weakly developed. Color pattern of young closely resembles that of adults in many species. In others having striking ontogenetic change, the process is gradual and is seemingly not correlated with attainment of adult size or sexual maturity.

In the course of population studies pursued over the past ten years at the University of Kansas Natural History Reservation, more than 2000 snakes of 14 species have been captured alive, marked and released. In most of these snakes sex was routinely recorded. Ordinarily snakes were examined, recorded and released at the point of capture. As the snakes involved differed greatly in size, the same probe could not be employed on all, and materials available in the field, such as semi-rigid stems of growing grass, with soft ends, were generally utilized as probes.

In the early stages of the study sex was not determined in many of the young snakes that were captured; it was anticipated that sex would be evident from the ratio of tail length to total length. Unfortunately this method of sexing proved not to be feasible in some species because the proportions differ but little between the sexes in the newborn young. In

the copperhead, for instance, there is a slight average difference, but males and females overlap widely; ratio of tail-length to snout-vent-length was 17.55±.143 per cent in 68 males and 17.20±.055 per cent in 26 females. In sexually mature copperheads of any given size the sexes can usually be separated on the basis of tail length. The ratio of tail-length to snout-vent-length averages from 1.3 per cent to 1.7 per cent more in males. Actually the ontogenetic change in each sex consists of a shortening of the tail in relation to snout-vent length; in the largest males (near 900 mm. snout-vent) the tail is relatively shorter (13.43 ± .334 per cent) than in the largest females (near 700 mm. snout-vent, with a tail ratio of 13.85 ± .099 per cent).

In snakes that are viviparous, females carry the eggs and embryos throughout a major portion of the season of activity. The gravid condition of such females is readily apparent from the distended appearance of their abdomens. Even in the oviparous species the enlarged ova may be carried over periods of weeks before they are laid. Numbers of eggs or embryos can be determined by palpation in the living snake, by sliding the thumb gently over the abdomen and counting the eggs as they slip past. Counts are most easily obtained in oviparous species, when the eggs have already entered the oviduct and their shells have formed, shortly before laying occurs. In copperheads I have sometimes made erroneous counts, overestimating the numbers of young because in the same egg the yolk and the embryo itself were felt as separate lumps.

In some snakes in which the hemipenis of the male is heavily armed with spines (for example, in *Coluber, Elaphe,* or *Agkistrodon*), the cloaca of the adult female, serving as a vagina, is correspondingly thick-walled. This cloacal capsule can be palpated from the ventral surface as a distinct hard lump in the posterior end of the body. In the adult males and young no such lump can be felt. Its presence in the female may, therefore, be regarded as an indication of sexual maturity.

As an indication of sexual maturity in males and of recent mating in females, samples of cloacal fluid were collected and examined. A few drops of Ringer's Solution were introduced by pipette into the cloaca, then withdrawn and examined under 60 power magnification with a binocular dissecting microscope with reflected light producing a "dark-field" effect. Often such samples were found to be swarming with active sperm. Females that had mated were found to retain live sperm in their cloacae for days or even weeks, but the proportion of sperm cells dead or not fully active rapidly increased with the passage of time.

In my field work in 1959 I made it a practice to test representative adults of each sex for active sperm. For this purpose I carried in the field, glass vials 50 mm. long and seven mm. in diameter, each containing several drops of Ringer's Solution. Before obtaining a sample of fluid from the snake's cloaca, I made it a practice to massage the posterior part of the abdomen, expressing any fecal material or uric acid present. After clearing the cloaca of these residual wastes, I repeated the massaging, in the male snakes, in order to squeeze sperm from the vas deferens before withdrawing a sample of the cloacal fluid. In many of the snakes examined, the hind gut had an abundant fauna of parasitic or commensal micro-organisms. Among these were protozoans approximately the same size as the sperm, for which they might have been mistaken under condi-

tions of improper lighting, but their movements were more erratic and they lacked the characteristic "tails" of the sperm cells. Presence of abundant active sperm was assumed to indicate that the individual was sexually mature and in breeding condition. Males of various kinds of common snakes were found to produce sperm at sizes and ages much below those of the most precocious breeding females. In the ring-necked snake (*Diadophis punctatus*) and racer (*Coluber constrictor*) for instance, sexual maturity is attained before the second hibernation when the snakes are approximately 13 to 14 months old and are still far short of typical adult size. In the copperhead (*Agkistrodon contortrix*) sexual maturity is usually reached before the third hibernation, at an age of approximately two years. Surprisingly, mature males of these species have active sperm throughout the season of their activity, or most of it, although ovulation and oviposition or birth of young takes place in all females of the population at approximately the same time, only once annually.

DEPARTMENT OF ZOOLOGY
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THE NORTHWESTERN SAGEBRUSH LIZARD IN DEL NORTE CO., CALIFORNIA.—Van Denburgh (1922, Occ. Pap. Calif. Acad. Sci., 10:1-611.) gives two Del Norte Co. localities for *Sceloporus graciosus gracilis* (Baird and Girard)—near state line on road from Crescent City to Grant's Pass and Gasquet. These localities were either discounted or overlooked by Smith (1946, Handbook of Lizards.) and Stebbins (1954, Amphibians and Reptiles of Western North America). On August 23-24, 1959, my son, Donald, and I obtained twenty of these lizards from about five miles east of the town of Smith River, Del Norte Co., in the locality called the Divide Area. The reptiles were found between High and Low Divide along what once was the stagecoach road from Smith River to Grant's Pass, Oregon.

The Divide Area and adjacent environs possess a somewhat remarkable flora. Although the collecting site is only 2,200 feet in altitude, it is characterized by plants usually found at higher elevations elsewhere—dwarf juniper, *Juniperus communis* var. *saxatilis*, 6,400-11,000 ft.; pinemat manzanita, *Arctostaphylos nevadensis*, 5,000-10,000 ft.; huckleberry oak, *Quercus vaccinifolia*, 6,000-10,000 ft. (Jepson, 1923-28, A manual of the flowering plants of California; Muntz, 1959, A flora of California.)

The lizards were found among these prostrate shrubs on a substrate derived from the exposed lavas that reflect the geology of the area. The exposed rocks and low shrubs, plus intervening small patches of soil, characterize the habitat. The environment is in keeping with known situations for this lizard.

Sceloporus occidentalis was also found in the Divide Area. The only place where both *Sceloporus* were found together was next to a shack at Low Divide. The *occidentalis* were usually right next to the shack; the *graciosus*, usually in the already described situation which occurred to within a few feet of the shack. In the Divide Area *occidentalis* was most often found in open rocky areas and among more open situations of *graciosus*-like habitat.

Although the Del Norte Co. sagebrush lizard localities are only about

50 miles distant from reported Siskiyou Co. sites, a new biogeographical region is involved. For this reason, a consideration of the morphology of the ten males and ten females is given. The dorsal pattern is typical of the subspecies *gracilis;* however, the patterns in one male and one female are dark and distinct enough to tend toward the type subspecies. The blue of the belly and throat are separated in all males, a *gracilis* character; but three males have the definite *vandenburghianus* joining of ventrolateral blue patches. All females have white venters. The number of dorsal scales and femoral pores, as well as snout-vent length, are within the range of *gracilis* variation. In males the number of dorsal scales average 59.6, standard error $\pm$ 0.99, range 55 to 64; in females, 57.6 $\pm$ 0.88, range 54 to 63. The number of femoral pores on right and left hind legs do not always agree. For the left hind leg males average 13.8 $\pm$ 0.33, range 12 to 15; females, 13.8 $\pm$ 0.39, range 12 to 16. Right femoral pores in males average 14.4 $\pm$ 0.41, range 12 to 16; in females, 14.6 $\pm$ 0.27, range 13 to 16. The snout-vent length of the males averages 46.7 $\pm$ 0.91, range 41 to 50; of females, 46.3 $\pm$ 1.30, range 37 to 51. None of the sexual differences is significant. These data assign the series to the race *gracilis.* —*Richard A. Pimentel, Biological Sciences Department, California State Polytechnic College, San Luis Obispo, California.*

POPULATION ESTIMATE OF THE RED-BACKED SALAMANDER.—Populations of red-backed salamanders (*Plethodon cinereus*) have been censused by previous investigators and the densities of salamander populations have been calculated. Burger (1935) stated that, "A small area of about 600 square yards may contain a hundred or more redbacks." Test and Bingham (1948) made four intensive searches of an area of 10,339 square meters (about 2.6 acres) and found 496 red-backed salamanders. The density was calculated to be one animal per 21 square meters. The four consecutive collections contained 118, 146, 131 and 101 animals and it was found later that there were still red-backed salamanders on the area. The authors concluded that, ". . . a very large part of the population is elsewhere than directly beneath cover, probably mostly underground."

In the light of the difficulty of censusing this species directly it is of interest to report the results of a population estimate obtained by using the Petersen (1896) method of population estimation (Lincoln Index). This estimate was derived from a census that was conducted as a class laboratory exercise while the author was an instructor in the Department of Biology, Swarthmore College. The cooperation of the twelve students in the course is gratefully acknowledged. William C. Denison of Swarthmore College kindly provided information about the vegetation on the study area. Neil D. Richmond, Carnegie Museum, Pittsburgh, Pennsylvania read the manuscript and made helpful suggestions.

The study area was located on the wooded slope of a stream valley on the Swarthmore College campus, Swarthmore, Delaware County, Pennsylvania. The woodland was generally composed of large, mature trees of which red oak (*Quercus borealis*) and tulip tree (*Liriodendron*

tulipifera) were most abundant. Also present were white ash (*Fraxinus americana*), beech (*Fagus grandifolia*) and sour gum (*Nyssa sylvatica*). On the study area the woodland was quite open at the lower levels of vegetation. A few specimens of red maple (*Acer rubrum*), flowering dogwood (*Cornus florida*), elderberry (*Sambucus canadensis*) and cultivated species of rhododendron (*Rhododendron* spp.) were present as shrubs or small trees. The soil was sandy loam underlain by gneiss which was exposed at places as rock outcrops. The censused area measured about 195 feet down the slope and 180 feet across the slope, making an area of about 35,100 square feet (3262 square meters), which is .81 acres (.33 hectares). At the uphill edge of the area was a small spring-fed pond which discharged a small stream downhill through the middle of the area. Another stream was located along the north edge of the area. There were many rocks at the surface of the ground and others below the surface, creating a system of small crevices in which salamanders could reside. This factor may have been primarily responsible for the high density of red-backed salamanders indicated by the population estimate.

The marking phase of the census took place on March 18, 1958. The air temperature was about 40°F. (4.5°C.). There were a few patches of snow left on the ground and the soil was moist from recent thawing. Surface rocks were overturned and red-backed salamanders were marked by clipping the tips of the toes of a rear foot. The salamanders were sexed and the color type was noted. They were then returned to the area in which they had been captured.

On April 1, 1958 the recapture phase of the census was conducted. In the intervening period a snowfall of two feet or more had occurred and had subsequently melted away. The temperature at the time of the census was between 50 and 60°F. (10 and 15°C.). Again, rocks on the study area were overturned and the salamanders that were found were inspected for evidence of clipped toes. They were again tabulated according to sex and color type. Sexing was done on the basis of the shape of the snout, the naso-labial area of the male being more swollen than that of the female. Sexing may have been somewhat inaccurate due to the method used. In both collections of salamanders the sex ratio was approximately 50:50. A summary of the numbers and percentages of gray-backed and red-backed color types is presented in Table 1.

In addition to searching the study area for salamanders, an area fifty feet wide outside the periphery of the study area was also inspected in the same way. Although 160 unmarked salamanders were taken, no marked ones were found. This indicates that, if the marked salamanders survived, there was little or no movement of them from the study area. The snow cover, which was present for most of the period, may have inhibited the normal movement of the salamanders.

Of the 62 salamanders marked at the beginning of the study, 16 were recaptured in the second collection of 179 animals. These data were used in the Peterson method of population estimation. The estimate obtained for the original population of salamanders was 694. The

95 percent confidence limits for this estimate were approximately 390 and 1240 animals (Adams, 1951). This indicates a density of 857 red-backed salamanders per acre (2118 per hectare) or one salamander per 51 square feet (4.7 square meters). What effect the heavy snowfall had on the salamander population is not known. With the large amount of rocky material present in the substrate, the animals could have retreated deeper into the crevices. The nature of the substrate also probably provided good drainage, and the large amounts of water resulting from the melting of the snow presumably did not cause any harm to the animals. At any rate, the possible mortality from the snowfall should

Table 1. Numbers and percentages of red-backed and gray-backed salamanders in two collections from Swarthmore, Pennsylvania. The April 1 collection includes only animals not previously handled.

Color-type of salamander	Collection				Total for Both Collections	
	March 18		April 1			
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Red backed	25	40	52	32	77	34
Gray-backed	37	60	111	68	148	66
Total	62		163		225	

have been distributed proportionally among the marked and unmarked salamanders and therefore should not have influenced the validity of the population estimate, which is an estimate of the population at the time of marking. A differential mortality between the marked and unmarked salamanders would cause error in the resulting estimate. If some of the marked salamanders died as a result of capture and marking, or were otherwise unavailable for recapture, the resulting estimate would be higher than the true population. There was no evidence that this had occurred and it was felt that capture and marking had had no appreciable effect on the survival and behavior of the animals. Hence, the estimate is considered a reasonable measure of the size of the population and indicates the density these animals may reach in a favorable habitat.

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Erratum: Vol. 15:234, line 30, "A *Crodylus crodylus*"—to read: A *Cordylus cordylus*.

Redescription of *Hyla valancifer*. Studies of American Hylid Frogs. III

By WILLIAM E. DUELLMAN

Until 1956 the bizarre fringe-limbed members of the genus *Hyla* were known only from lower Central America (Nicaragua and Costa Rica) and from Colombia and Ecuador in South America. Firschein and Smith (1956, Herpetologica, Vol. 12: 17-21) described *Hyla valancifer* from Volcán San Martín in southern Veracruz, México. This brought to seven the number of described species of fringe-limbed *Hyla,* which were referred to the *tuberculosus* group by Firschein and Smith (*loc. cit.*). Each of the seven species (*tuberculosus* Boulenger - Ecuador, *miliarius* Cope - Nicaragua, *phantasmagoria* Dunn - Colombia, *fimbrimembra, immensa,* and *richardtaylori* Taylor - Costa Rica, and *valancifer* Firschein and Smith - México) is known only from a type specimen. The type of *Hyla valancifer* is a poorly preserved juvenile having a snout-vent length of 22 mm. The specimen was not accompanied by notes on its color in life. Therefore, the acquisition of a second specimen, described below, of *Hyla valancifer* is noteworthy.

This second specimen was obtained on the night of January 22, 1958, by Richard E. Etheridge and myself at an elevation of 1180 meters on the south slope of Volcán San Martín in Los Tuxtlas, Veracruz, México. The frog was found on the upper side of a palm frond about eight meters above the ground in a shallow ravine in dense tropical evergreen forest.

Description of specimen (University of Michigan Museum of Zoology, No. 118157); immature female; snout-vent length, 35.4 mm.; tibia length, 18.8 mm.; foot length (from proximal edge of inner metatarsal tubercle to tip of longest toe), 15.4 mm.; head width, 14.6 mm.; head length, 13.5 mm.; interorbital distance, 4.5 mm.; internarial distance, 3.5 mm.; greatest width of eyelid, 4.0 mm.; diameter of eye, 4.4 mm.; diameter of tympanum, 2.5 mm.; distance from anterior corner of eye to nostril, 3.9 mm.

Tongue broadly cordiform, shallowly notched behind, and free for about one-fifth its length; choanae nearly round; vomers high, rounded, and narrowly separated, situated between choanae; 6-5 vomerine teeth. Snout short (28.7 per cent of head length), and nearly vertical in lateral profile; nostrils near tip of snout, which, when viewed from above, is indented medially, but square in profile and extending beyond labial border; labial and loreal region convex; canthus curved medially from anterior corner of eye to protuberant narial region. Eyes large, protuding beyond labial border when viewed from above; tympanum directed dorsolaterally and distinctly raised, its upper edge covered by a heavy dermal fold beginning at posterior corner of eyelid, arching above tympanum and terminating above insertion of forearm; diameter of tympanum slightly more than 50 per cent of diameter of eye, and separated from eye by a distance slightly less than diameter of tympanum. Axillary web small;

[1]Previous studies in this series are: I - The Frogs of the Hylid Genus *Phrynohyas* Fitzinger, 1843. Misc. Publ. Mus. Zool. Univ. Michigan, No. 96: 1-47, 1956, and II - Sexual Dimorphism in the Hylid Frog *Agalychnis dacnicolor* Cope and the Status of *Agalychnis alcorni* Taylor. Herpetologica, vol. 13: 29-30, 1957.

forearm not noticeably more robust than upper arm; distinct radio-humeral membrane; low fold of skin along lateral edge of forelimb continuing onto hand and fourth finger as a low scalloped fringe. Web between first and second fingers rudimentary; other fingers half-webbed; prepollex large; three low, rounded, white palmar tubercles on lateroproximal base of palm; subarticular tubercles large and obtusely conical, not bifid;

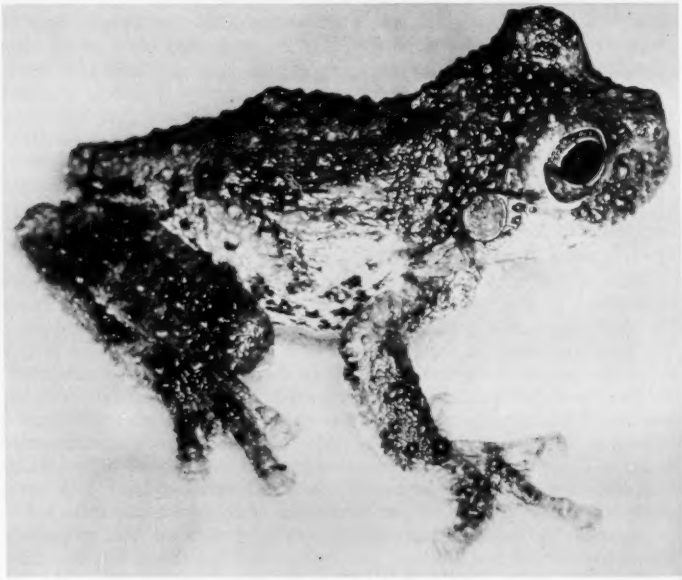

Fig. 1. Living individual of *Hyla valancifer* from Volcán San Martín, Veracruz, México. This specimen (now UMMZ 118157) has an actual snout-vent length of 35.4 mm.

supernumerary tubercles arranged roughly in single rows on all digits except thumb, which has two rows proximal to subarticular tubercle; disc of thumb not noticeably wider than digit; discs of fingers relatively small; disc of third finger largest, about one-half diameter of tympanum. Three small, conical, white tubercles on median surface of heel; a low, scalloped fold along ventromedian edge of tarsus and edge of fifth toe; tibiotarsal membrane extending as thin fold along lateral edge of tarsus; tarsal fold low; outer metatarsal tubercle round and flat, somewhat smaller than elliptical inner tubercle; subarticular tubercles small and round; supernumerary tubercles poorly developed; toes completely webbed with exception of fourth, which is webbed to base of penultimate phalanx; discs small, about two-fifths diameter of tympanum; anal opening poster-

ior without elongate flap; many small white tubercles lateral and ventral to anal opening. Skin above, smooth with scattered small tubercles, especially on head and eyelids; belly and ventral surfaces of thighs lightly granular; skin of belly thin and partially transparent; chin smooth.

In life, dorsum light tan, mottled with dark green; flanks mottled with ivory and dark chocolate brown; webbing reddish brown; posterior surface of thigh reddish brown mottled with cream (Fig. 1). Iris reddish brown.

When the frog was collected, the green on the dorsum was light and irridescent. During the two weeks the frog was kept alive, considerable metachrosis was observed. The dorsal ground color often changed to dark reddish brown with olive green markings or to pale tan with light green markings.

Radiograms of this specimen show several interesting features of cranial osteology; however, some characters cannot be ascertained definitely without skeletal preparations. There is a blunt anterior projection from each premaxillary; these are separated by the median indentation in the snout described above. There appears to be a quadratojugal, but the anterior horn of the squamosal does not reach the quadratojugal or maxillary. The frontoparietal fontanelle is covered with a thin layer of bone or cartilage. In the large prepollex there is no bony spine, but this may develop in larger individuals. Probably an anomalous condition is the presence of a single postsacral vertebra bearing well-developed lateral diapophyses.

In comparison with the holotype of *Hyla valancifer* (Univ. Illinois Mus. Nat. Hist., No. 35398), which is questionably a male, having a snout-vent length of 22 mm., the present specimen agrees well in most proportions. The holotype has a relatively smaller head; the head width/snout-vent length ratios of the holotype and present specimen are, respectively, 36.3 and 41.2 per cent; the head length/snout-vent length ratios are 34.5 and 38.1 per cent. Due to the shrunken condition of the holotype, the validity of the measurements and subsequent ratios is questionable. Firschein and Smith (1956:18) stated that the type has large, scattered, round tubercles on the dorsum, and that the skin of the belly and ventral surfaces of the thighs is granular. This probably is a juvenile characteristic. Duellman (1956, Misc. Publ. Mus. Zool. Univ. Michigan, No. 96: 31, 33) showed that in a large ontogenetic series of *Phrynohyas spilomma* the relative tuberosity of the skin diminished with age.

The area from which the frog was collected is high, wet forest; there is no standing water, for the volcanic soil is extremely porous. A small intermittent stream flows sporadically near the site of collection. Possibly this species breeds in arboreal bromeliads, like *Hyla dendroscarta* of Veracruz, *bromeliacea* of Guatemala and Honduras, *lichenata, marianae,* and *wilderae* of Jamaica, or in holes in some of the large trees.

Acknowledgments.—I am indebted to Dr. Hobart M. Smith for permission to examine the holotype of *Hyla valancifer,* to Dr. Richard E. Etheridge for his assistance in the field, and to the Graduate School of Wayne State University for supporting my field studies.

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NOTES ON A COLLECTION OF ANURANS FROM THE CANAL ZONE.—Smith and Grant (*Herp.* 14, 1958: 207-215) reported on the snakes of a herpetological collection made by Chapman Grant January 30 to March 13, 1958. The present paper deals with the anurans, collected within a three-mile radius of the Fort Clayton Military Reservation and now in the University of Illinois Museum of Natural History. I thank Major Chapman Grant and Hobart M. Smith for the loan of this collection.

The amphibians of Panama and the Canal Zone are less well known than the snakes. I am compiling a check list of anurans of this region and the tentative list of known species numbers 103, of which 53 are known from the Canal Zone. Twenty of these are represented in the collection at hand by 132 specimens. Those worthy of note are discussed in detail. Only one tailed amphibian is represented in the collection, *Caecilia ochrocephala* (4 specimens). The anurans are BUFONIDAE - *Bufo granulosus* Spix (1), *B marinus* (Linnaeus) (25), *B. typhonius* (Linnaeus) (24): BRACHYCEPHALIDAE - *Dendrobates auratus* Girard (11), *Hyloxalus panamensis* Dunn (2), *Phyllobates nubicola flotator* Dunn (2); LEPTODACTYLIDAE - *Eleutherodactylus cerasinus* (Cope) (1), *E. fitzingeri* (Schmidt) (27), *E. gaigei* (Dunn) (6), *E. ockendeni* Boulenger (2), *E. talamancae* Dunn (1), *Eupemphix pustulosus* (Cope) (4), *Leptodactylus bolivianus* Boulenger (4), *L. labialis* Cope (6), *Pleurodema brachyops* (Cope) (1); CENTROLENIDAE - *Centrolene prosoblepon* (Boettger) (1), *Teratohyla spinosa* (Taylor) (1); HYLIDAE - *Hyla boulengeri* (Cope) (1), *H. microcephala* Cope (5); RANIDAE - *Rana warschewitschii* Schmidt (1).

Hyloxalus panamensis Dunn. UIMNH 42016-17. This is the first record from the Canal Zone. It has previously been known only from the type locality of El Valle, Panama. It closely resembles the somewhat smaller *Phyllobates nubicola,* from which it may be readily distinguished by the light line from the groin extending only halfway to the eye, and located in the middle of the dark lateral band, whereas in *nubicola* the light lateral line extends from the groin to the eye and forms the medial border of the black band.

Eleutherodactylus cerasinus (Cope). UIMNH 42015, immature, 16.4 mm.; vomerine teeth not visible. This represents the second known specimen from the Canal Zone, although the species is known from other localities in western Panama.

Eleutherodactylus talamancae Dunn. UIMNH 42071, male, 23.6 mm. This is the first record from the Canal Zone, although it has been taken as far east as El Valle, Panama. The characteristic supratympanic fold is boldly marked with black and there is a distinctive transverse black line across the orbital region.

Pleurodema brachyops (Cope. UIMNH 42001, male, 34.6 mm. Although this species is represented in several collections from Panama, I have never seen a published record. This is apparently the first record from the Canal Zone, although it should occur there inasmuch as several specimens are at hand from Coclé, Panama.

Lumbar glands rounded, slightly longer (4.7 mm.) than wide, black with a few light spots; groin below gland and posterior concealed surface of femur red; two shovel-shaped metatarsal tubercles; length of eye 4.4 mm.—*M. J. Fouquette, Jr., Department of Biology, University of Florida, Gainesville, Florida.*

Herpetological Notes for Northwestern Jalisco, Mexico

By WILMER W. TANNER AND W. GERALD ROBISON, JR.

During the summers of 1956 and 1957, three separate field trips were made into Mexico. Although most of our energies were spent in the state of Chihuahua, on two occasions brief visits were made to the western states of Jalisco and Nayarit. The material reported here was taken on July 8, 1956, 12 miles north of Magdalena and approximately .5 mile SE of Nayarit-Jalisco-line; and on September 5, 1957, 7.5 miles north of Magdalena, Jalisco. The latter locality is (as are the others) near highway 15, and includes a small stream and pond, meadows and gentle grassy slopes from the valley floor up to the forested hills. Although only thirteen species were taken, some are represented in collections by only a few specimens; these are discussed below. Such species as: *Tomodactylus nitidus petersi* (12 mi. N. Magdalena), *Leptodactylus melanonotus, Pternohyla fodiens, Hyla eximia, Microhyla usta usta, Rana pipiens, Kinosternon* sp., *Sceloporus d. dugesi* and *Masticophis flagellum lineatus* (7.5 mi. N. Magdalena) are of mere locality interest.

All specimens are deposited in the Brigham Young University Natural History Museum (BYU).

Cnemidorphorus sackii occidentalis Gadow. On occasions one is fortunate enough to secure natural history information concerning a reptile. On July 8, 1956, approximately 12 miles north of Magdalena, two freshly laid clutches, of four eggs each, were found under flat rocks near the road. With the eggs, in both cases, was a female, one of which was gravid containing four large eggs. The eggs were placed in moist soil and an attempt was made to bring them through to the laboratory. Unfortunately, we were not prepared for such an experience and the eggs were overheated while crossing the Sonora and Arizona desert areas.

On September 5, 1957, this same area was again visited without finding any additional materials. However, in the area 7.5 miles north of Magdalena, two nesting areas were discovered. In all, nineteen eggs were found, six under one rock and thirteen under another. The latter probably represented at least two clutches. This is assumed because, in two eggs opened shortly after collecting, one contained a well-formed embryo with the scales, toe nails and color pattern well formed. The snout to vent length is 25.6 and the total length 74.0 mm. The other egg contained a much smaller embryo, with large eyes and head, and without scales, nails or a color pattern. Also there was considerable unused yolk.

Two eggs measured 15.8 x 10 and 16.0 x 10. Those taken on July 8, 1956, were not measured; however, they were smaller and were white shelled. Six of the remaining seventeen hatched between October 10 and October 20. The hatchlings ranged in snout-vent length from 29.7 to 31 mm.

Although these data are incomplete they do indicate (a) that egg laying begins at least in early July, and since we did not observe a single hatchling at either locality in early September, (b) that hatching begins in late September and continues into October, and (c) that communal nests occur in this species.

Coniophanes lateritius lateritius Cope. A specimen (BYU 12795) of this species and presumably the third of this subspecies taken in Jalisco was found under a rock on a grassy hillside 7.5 miles north of Magdalena.

This specimen has essentially the same color pattern as the specimens described and figured by Smith and Grant (1958, Herpetologica 14:20-22, fig. 1), and Wellman (Herpetologica 15:127-8), but with more small light spots on the nape and temporals. The specimen is small and these slight variations may be age differences. Posterior to the nape the body is dark red dorsally, fading to a salmon on the edge of the ventrals and becoming yellow ventrally.

The scutellation is as follows: scale rows 19-19-17, ventrals 148, caudals 88, supralabials 7-7, infralabials 9-9, preoculars 2-2, postoculars 2-2, one loreal, temporals 1-2; total length 193, and tail 56 mm.

All four recently taken specimens have 19-17 rows, 7-7 supralabials, 9-9 infralabials, 2-2 pre-and postoculars, one loreal, 1-2 temporals and the ventrals and caudals range from 140-151 and 88-99 respectively. Three are males which range from 148-151 and 88-91 in the latter counts.

It is rather amazing that additional specimens were not taken from 1861 (original description) until four were taken from 1956 to 1958. The finding of a specimen at Puerto Vallarta, led Smith and Grant (*loc. cit.*) to suspect that the type was actually collected in the more humid coastal habitat rather than in the semixeric highlands, and that the type was mis-labeled "Guadalajara." The finding of this species in an upland habitat very similar to that of Guadalajara seems to remove such a suspecion and re-establish the original type locality. Furthermore, we must now assume that this species has a rather wide and varied habitat range.

According to Bailey (1938, Pro. Mich. Acad. Sci., Arts Lett., 24:28-29) and others the type specimen is lost. Because the present specimen (BYU 13793) is so similar to the original description and also was taken near the type locality, we are designating it as the neotype.

Lampropeltis doliata arcifera (Werner). One DOR specimen (BYU 13181) was taken on highway 15 approximately .5 miles SE of the Jalisco-Nayarit state line. The specimen is badly mashed anteriorly but was not spoiled and has all characters clearly discernible.

In scutellation it is similar to both *d. nelsoni,* and *d. arcifera,* having 221 ventrals and 51 caudals, but the color pattern is that of the latter. The dorsum of head, including snout, is black, without any light or reddish mottling. Only first and last red body rings are complete ventrally, and two are divided by black dorsally; all, save first, are narrowed dorsally by expanded black. There is a slight increase in dark pigments near the tip of many red scales but not forming black tips. There are 21 white annuli, five on tail; these average two scales long dorsally and are wider ventrally. The tail pattern is of black and white rings. The body color is Nopal Red (Ridgway 1912) dorsally becoming lighter red on the edges of the ventrals.

Why *arcifera* occurs in what appears to be the range of *nelsoni* cannot be explained on the limited data available.

Hypsiglena torquata affinis Boulenger. One adult male specimen (BYU 13794) was taken from under a rock, 7.5 miles north of Magdalena. Only two other specimens are definitely known, one from Mezquital del Oro, Zacatecas and one from near Magdalena, Jalisco. The latter was

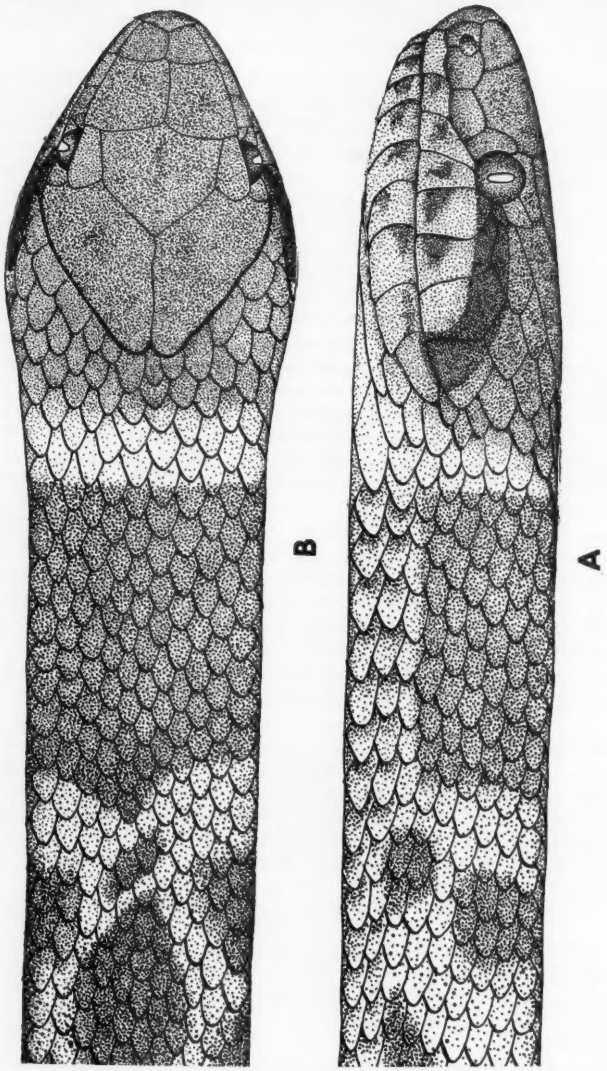

PLATE I

Hypsiglena t. affinis. BYU 13794. Fig. A, lateral view showing eight supralabials. Fig. B, dorsal view.

taken by Hobart M. Smith, June 1, 1935, and reported by Taylor (1938, Kansas Sci. Bull. 25:370-1). This specimen was described and figured by Tanner (1946, Great Basin Nat. 5:89 pl. figs. 2 and 6).

In scutellation the present specimen agrees with the others in having 19-19-17 scale rows and one preocular; it is different in having 7-8 supralabials and 9-10 infralabials. There are 159 ventrals, 49 caudals, 2-2 postoculars; total length 369 and tail 63 mm.; nape blotch nine scales long; white nape band two scales long and there are 46 large median body spots.

Boulenger described *Hypsiglena affinis* in 1894 (Cat. Snake British Mus. II:210-1) and listed Jalisco and Zacatecas as the type locality.

Taylor (*op. cit.*) and Tanner (*op. cit.*) concluded that *affinis* represented a distinct species based on the reduced dorsal rows, a single preocular, seven supralabials, and the characteristic color pattern. In recent years additional specimens have been seen from Aguascalientes, (Stanford University 19508, two specimens) which approach the characteristics of *janii* both in scalation and pattern. Specimens from southeastern Chihuahua also, but to a lesser extent, tend toward *janii;* that is the nape blotch becomes large and darker, there is a reduction in the numbers of ventrals and caudals and the dorsal blotches are fewer in number and with less space between them. It is not expected, therefore, that *affinis* extends eastward onto the Mexican plateau even in Zacatecas, but occupies the upland area of northeastern Jalisco and western Zacatecas. Presumably *torquata* occurs only in the coastal foothills of western Jalisco. Two specimens of *torquata* (UI 41447-8) from Puerto Vallarta, (Smith & Grant, Herpetologica 14:22) are not only important in establishing *torquata* in Jalisco, but also in strongly indicating that the populations occurring in Sinaloa and Nayarit are not disjunct but connected in western Jalisco with the southern population in Michoacán.

The placing of *affinis* as a subspecies of *torquata* is based on the following data: (a) the general habitus is the same, that is: size, shape of head and snout, and the scales are the same, except that most do not have the apical pit. (b) In males of *affinis,* as in other *torquata,* those scales above the vent have the nob-like keels; (c) nineteen rows of dorsal scales are also found in *t. nuchulata*; (d) the reduction to seven supralabials is modified to a 7-8 formula in the present specimen; however, most *t. nuchulata* also have only seven upper labials; (e) the color pattern is basically the same as that of *t. torquata,* varying primarily in the size of the nape bands.

In both *t. torquata* and *t. affinis* the dorsal spots are large and separated by less than two light colored scales. There is a light nuchual band of two or more scales in length in front of the large nape blotch. The nape blotch is large and conspicuous, but not larger than that of most *janii* and is approached in size by *torquata.* Only in the single preocular do we find a character that is not found in other subspecies of *torquata.*

After having observed the specimen while it was alive, and compared it with all the available data, for the genus *Hypsiglena,* we believe that *affinis* is a very distinct subspecies of *torquata* but does not warrant the rank of a full species.

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Storeria Storerioides in Western Mexico

By JAMES D. ANDERSON

The range of *Storeria storerioides* (Cope) as outlined by Trapido (1944) includes the southern portion of the Mexican Plateau and adjacent areas of the Sierra Madre Occidental and Sierra Madre del Sur, from southern San Luis Potosi south to Morelos and north to central Jalisco in the west. Trapido questioned the isolated record from far to the north in Durango: "Ciudad in Durango" (Gunther 1894). However, there is a specimen in the Museum of Vertebrate Zoology (56977) from El Salto, Durango confirming the old record. Trapido's reluctance to accept Gunther's record may have been caused by his interpretation of Ciudad as Ciudad Durango as indicated by his map (page 13). However, there is a town, La Ciudad, near El Salto which is probably Gunther's locality and not Ciudad Durango on the arid plateau.

In July 1957 I collected two specimens of *storerioides* at Yaguirachic, 8500 ft., 130 mi. west Chihuahua, Chihuahua (29 degrees 35 minutes N. latitude, 108 degrees 10 minutes W. longitude) which extends the range almost 400 miles north of the El Salto locality.

In scale characters the three northern specimens fall within the range of variation as given by Trapido. Table 1 summarizes these and characters of specimens discussed below. Since there seems to be some doubt about the ventral coloration of *storerioides* and few color descriptions of fresh specimens in the literature, the following color notes are presented. The descriptions of the Yaguirachic specimens (66105 & 66104) were made from living snakes, the others from preserved specimens.

Coloration: MVZ 66105 ♀. Head brown with a melanic stippling irregularly aggregated to form a dark network. Occipital markings short, extending only three scales posterior to the parietals. Black punctations sparse on labials and chin region; tend to be absent in the sutures between scales.

Dorsal ground color brown, marked with an irregular series of narrow black crossbands, less than one scale wide, frequently incomplete and often crossing the back diagonally. This pattern of about 45 bands fades out posteriorly, the bands absent or represented only as spots.

Lateral edges of ventral and subcaudal scales stippled with black. In life the ventral surface was a pale salmon red from tip of tail to the level of the 15th ventral. Posteriorly the reddish color extended almost the full width of the ventrals, the lateral edges appearing dark gray; anteriorly it narrows and comes to a point between the 10th and 15th ventral.

66104- juv. ♂. Similar to 66105 but the pattern less distinct, the bands seldom complete and about ½ scale in width. Only 27 bands can be counted, including 5 incomplete on the neck. In life the ventral surface is a brighter orange-red. In both specimens the ventral color faded soon after preservation and both specimens are now without a trace of reddish color. Trapido (*op. cit.*: 8 & 19) states that the belly is white or gray, but quotes Boulenger's description of a specimen with a reddish venter without comment.

56977- ♂. El Salto, Durango. Like above but with denser melanic stippling on head. Entire side of head darker, especially in temporal region.

Occipital marking longer, 4½ scales in length. Crossbands narrow and indistinct, numbering 47 before becoming obscured posteriorly.

Two additional *storerioides* in the MVZ collection are of interest. MVZ 57297 an adult ♀ from San Juan de los Llanos (3 mi. N. Tzitzio), Michoacan is melanistic. It is extremely dark, much like the one described by Trapido (*op. cit.*: 11-12). The head is almost normal in coloration but with a heavier concentration of melanic stippling, especially on the labials. The first 4 or 5 ventrals are normal in color but posteriorly a heavy concentration of black punctations is present on all ventrals. These dark markings are heaviest laterally and faint on the mid-line. Thus the belly appears black with a light line, one millimeter or so in width, down the center. The dorsal surface is very dark. The crossband pattern would be obscured but the tips of the scales forming the bands are unusually light, outlining the bands and making them visible against the dark ground color.

MVZ 52144. Cerro Tequila, 8000 ft., 7 mi. S. Tequila, Jalisco. This female is melanistic, similar to the preceding but with the ground color slightly lighter, the ventral surface less intensely pigmented and the light area in the mid-ventral line approximately 2-3 mm. wide. However, it is much darker than "typical" specimens, especially on the venter which is whitish in most preserved *storerioides* and slate colored in this individual.

Trapido described one melanistic individual from Jalisco and commented upon others from Guerrero, indicating that the latter might represent part of a distinct population. The dark individuals reported on here clearly indicate the high incidence of melanistic *storerioides* in the southwestern portion of the range. However, there is not sufficient material for a complete analysis, especially since the dark individuals apparently occur on either side of the Rio Balsas drainage where a faunal break might be expected.

Trapido did not include a habitat discussion for this species, stating only that it is limited to the humid and temperate parts of the southern Mexican Plateau. He considered its distribution limited by arid conditions in the northwest, ignoring the continuous and suitable habitat present in the Sierra Madre from Jalisco to Chihuahua. Most of the known localities for *storerioides* fall within the pine-oak zone as mapped by Leopold (1950. The one exception is the locality listed as "Mtns, near Jesus Maria, San Luis Potosi" by Trapido (*op. cit.*:13). However, Goldman (1951:244-245) describes pine-oak forest at this locality. It thus appears that *storerioides* is characteristic of this zone mainly surrounding the plateau but also existing in isolated pine-oak areas which occur in the more arid portions of the plateau (Fig. 1).

This range extension for *storerioides* is of special interest since Trapido and others consider this species as the most primitive member of the genus *Storeria.* The distribution pattern of the species is now similar to that of several reptiles which are found in the pine-oak-madrone forests of both the Sierra Madre Occidental and Oriental: *Sceloporus jarrovi, S. grammicus,* and *S. scalaris.* The most interesting aspect is that *storerioides* or its ancestral line, according to Trapido, has given rise to a number of diverse forms in northeastern Mexico and the eastern United States, whereas the northwestern arm of the species has remained relatively unchanged and has not been able to penetrate the arid southwestern United States. Ap-

parently this was true in the past also, for if *storerioides* or *pre-storerioides* stock had been present in the western United States we would expect to find disjunct populations or close relatives in suitable habitats in Arizona and New Mexico.

Martin (1958:90) has suggested the possibility of a trans-plateau dispersal in the past for certain amphibians and reptiles occurring in both the Sierra Madre Occidental and Oriental. In view of this snake's preference for the almost continuously present forest habitat at higher elevations south of Chihuahua (Leopold 1950), a southern origin for the

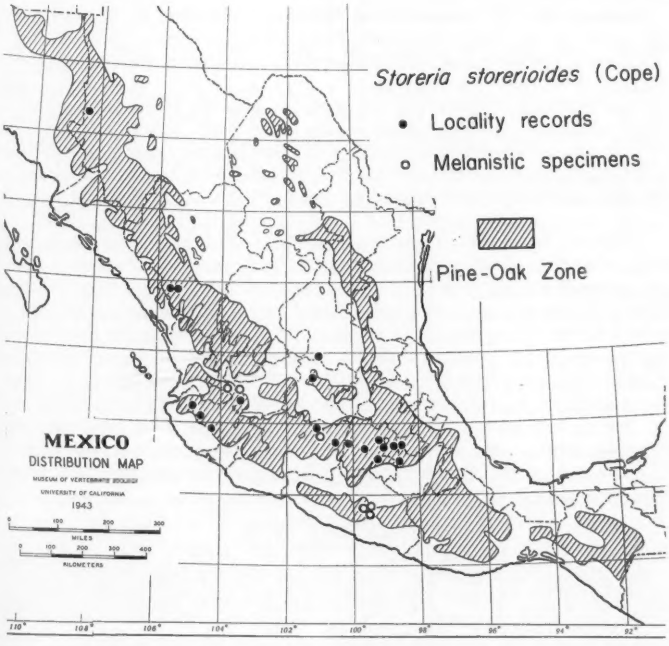

Fig. 1. Distribution of *Storeria storerioides* plotted to show relation to the Pine-oak zone.

northern population seems most likely, although it probably was once more widespread on the plateau as indicated by its presence on isolated pine-oak "islands."

The following notes are presented since there is little known of the habits of this secretive snake.

Ecologic Notes. Both Chihuahuan specimens were taken near a small moist meadow at 8 300 ft. in the Sierra Madre Occidental. A uniform yellow pine forest (*Pinus chihuahuana*) surrounded the meadow. Various oaks and madrone trees (*Arbutus*) were scattered on adjacent slopes. The

juvenile was found crawling on the surface at 9 a.m., July 2, 1957. Air temperature ½" above ground 16.2°C., soil temperature 13.8°C. The ground was very moist due to heavy rain the previous afternoon. The adult ♀ was taken under a yellow pine log on July 3, 1957. It had a body temperature of 17.0°C. *Eumeces multivirgatus, Sceloporus jarrovi* and *S. grammicus* were abundant in the same area.

MVZ 57297, the Michoacan specimen mentioned above was taken from the stomach of a Mexican Motmot (*Momotis mexicanus*) known to feed on lizards and other small animals. The snake is only slightly battered about the head and is a good specimen.

Table 1. Meristic characters of specimens discussed in this paper.

Number	Sex	Body length	Tail length	Ventrals	Sub caudals	Supra labials	Infra labials	Post oculars	Post temporals	Loreal in orbit
66105	♀	177	38	127	37	6-7	6-6	2-2	2-2	Rt. & left
66104	♂	121	33	124	49	7-7	7-7	3-2	2-2	Neither
56977	♂	169	47	119	43	7-7	7-7	2-2	2-2	Neither
57297	♀	250	61	139	44	7-8	6-6	3-2	2-3	Neither
52144	♀	247	55	137	39	6-6	7-8	2-2	2-3	Neither

Reproduction. The Yaguirachic female (66105) collected on July 5, 1957, contained five large embryos. The yolk material is much reduced and embryos are full term. The coiled embryos ranged from 16 to 99 mm. in length; one measured 64.0 mm. in total length. This record adds another species to the following list of reptiles which apparently time their breeding season to the onset of summer rains in mountains of northwestern Mexico: *Eumeces brevirostris, E. multivirgatus, Sceloporus jarrovi, S. grammicus* and *S. scalaris* (Zweifel, 1954 and Anderson & Wilhoft, 1959).

Acknowledgements. I wish to thank Dr. Seth B. Benson for constructive criticism and for assistance in determining localities. Dr. Robert C. Stebbins read the manuscript and offered many useful comments. Gene M. Christman kindly prepared the distribution map.

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New and Unusual Serpents from Chihuahua, Mexico

By WILMER W. TANNER AND W. GERALD ROBISON, JR.

In the checklist of the snakes of Mexico by Smith and Taylor (1945, USNM Bull. 187:205) is a rather imposing list of 43 species and subspecies for the state of Chihuahua. We can now add a new species of *Geophis* (Legler 1959, Univ. Kans. Publ. Mus. Nat. Hist. 11:329), the species *Thamnophis melanogaster* (Tanner 1959, Herpetologica 15:170), and representatives of the following genera: *Leptotyphlops, Ficimia, Storeria, Rhinocheilus,* and *Drymarchon**. The latter, except for *Storeria,* were taken by us during the summers of 1958 and 1959. Besides these, which are new to the Chihuahua fauna, there are additional specimens of several species which have previously been known by only a few representatives.

In general the geographical range for the serpents reported below, fall into two groups, those with ranges extending into Chihuahua from the south and west, such as: *Geophis, Storeria, Drymarchon,* and *Thamnophis melanogaster,* which are found only in the Pacific drainage; and those species whose range dips into Chihuahua from the north and are east of the continental divide, such as: *Leptotyphlops* (two species), *Rhinocheilus, Ficimia, Sonora,* and *Tantilla nigriceps.*

Many friends have aided us while collecting in the areas near Colonia Juarez, Casas Grandes and Chihuahua City. For their many courtesies and friendly help, we are especially grateful to the Herman and Roy Hatch, Alma Jarvis, Keith Bowman and Harold Pratt families.

Leptotyphlops dulcis dissectus Cope.—A single specimen (BYU 15210) was found in April 1959 by school children at Colonia Juarez. It was found crawling in a sandy ditch near an old rock wall. We are indebted to Virginia Hatch for having saved the specimen for us.

It is 167 mm. in total length and has the following scale characters: scale rows 14-14-10; mid-dorsals 237; caudals 15; prefrontal, frontal and supraoculars subequal in size; interparietal twice size of frontal; interoccipital equal to frontal, but smaller than fifth dorsal; right occipital single, left divided; right supralabial single; five infralabials. Five median dorsal rows anteriorly and seven over most of body a dark brown.

In the characters listed this specimen is very near the average for the subspecies as set forth by Klauber (1940, Trans. San Diego Soc. Nat. Hist. Vol. IX, No. 18:112-117). Apparently this is the first record of a worm snake from Chihuahua and extends the range of *dulcis* to the southwest.

Leptotyphlops humilis segregus Klauber.—One specimen (BYU 15211) was taken from under a rock on a sandy ridge 6.7 mi. N of Chihuahua City, September 7, 1959. It is 113 mm. in total length and has the following scale characteristics: scale rows 14-14-10; mid-dorsals 258; caudals 16; fifth mid-dorsal scale noticeably larger than those preceding or following it; other head scales normal. Seven dorsal scales of head darker than body. Except for the enlarged fifth mid-dorsal, we have been unable to observe significant variations from those listed in the original description.

*A discussion of the genus *Drymarchon* is included in another study.

The finding of this specimen not only adds another species to the Chihuahua fauna but extends the range of *h. segregus* approximately 200 miles to the southwest of its previously known range. Smith and Taylor (1945, USNM Bull. 187:22) list under this form "an indefinite record of *humilis* from Batopilas." We have found the reptiles of southwestern Chihuahua to bear a closer relationship to those occurring in Sinaloa and, therefore, suspect that the *humilis* (if present) in the Rio Fuerte drainage would belong to *h. dugesi.*

Storeria storeriodes (Cope).—Among a series of *Thamnophis* received from Dr. John M. Legler, University of Kansas, is a small specimen of this species secured 2 mi. W of Samachique (KU 47319). It is only 85 mm. in total length and has the following characteristics: scale rows 15-15-15; ventrals 128; caudals 38; supralabials and infralabials 7-7; preoculars 2-2; postoculars 2-3; loreal 1-1; temporals 1-2 and anal divided. First scale rows not keeled; and sixth row with a series of dark brown spots, each slightly larger than a scale. Supralabials longer than high and with loreal entering orbit between preoculars. Eye large, its diameter equal to distance from orbit to nostril, and with two scales between posterior chinshields.

The occurrence of this species in the mountains of southwestern Chihuahua is perhaps to be expected in view of the northern extentions of its habitat type. This appears to be the first record from Chihuahua.

Diadophis regalis subsp.—Two specimens taken 10 mi. NW of San Francisco del Oro, (BYU 14251) and 2 mi. E of Cerocahui, (BYU 14243), Chihuahua, are so variable as to be difficult to include in the existing subspecies listed for Chihuahua. The former was taken while crossing the road in the desert foothills. It is an adult female without a light neck ring and with all other color and scale characters (except the ventrals which are high at 243) similar to those of a series from Utah and Arizona. We suspect this specimen to be *r. regalis* and to represent a range extention of the population of this subspecies into Chiahuahua from the western Texas area.

The Cerocahui specimen should, on the basis of distribution, belong to the subspecies *r. laetus.* However, there are three cahracters: no. of ventrals, ♂ 195; no. of temporals, 1-1 and 1-2; and the lack of the ventral color on the lower rows of the dorsals; which do not agree with the key and descriptive characters presented by Blanchard (1942:17), and Smith and Taylor (1945:46). In all three characters there is a similarity to those of *D. dugesi.* In fact this specimen keys more readily here than to *regalis.*

The collecting locality is in the drainage of the Rio Fuerte, representing a southern extention of the range and indicating the real possibility that *regalis* and *dugesi* may intergrade in the area between southern Chihuahua and Nayarit.

Arizona elegans expolita Klauber.—A single male specimen (BYU 15254) was taken along the road 2.2 mi. SE of Nuevo Casas Grandes, September 14, 1959. In the original description (Klauber 1946, San Diego Soc. Nat. Hist. Vol. 10, No. 17:340) only three specimens were

studied, the type coming from Casas Grandes.* Perhaps this specimen is near enough to be considered a topotype.

Characteristics: scale rows 25-27-19; ventrals 198; caudals 50; supralabials 8-8; infralabials 13-13; preoculars 1-1; postoculars 2-2; and temporals 2-4.

The color pattern consists of a series of 58 large dark-edged rust brown dorsal spots and a row of smaller alternating lateral spots; small dark spots occupy the area between the larger spots and the ventrals. Between the spots is a soft rose-buff, which blends with them.

Lampropeltis getulus splendida (Baird & Girard).—Six specimens (BYU 13515, 14138, 15252, 15182, 15183, and 15283) were taken 28 mi. W of Chihuahua City, 2.3 - 11.4 mi. N of Chihuahua City, on Rio Santa Maria near Galeana and 14.6 mi. E of San Buenaventura during the summers of 1956-1959.

Characteristics: scale rows 23-23-19, 23-23-21, or 23-25-19; ventrals 209-217; caudals 51-58; supralabials 7-7 or 7-8; infralabials 9-9 or 9-10; preoculars 1-1; postoculars 2-2; and temporals 2-3 or 3-4.

Apparently the only previous records of *splendida* for Chihuahua are from San Diego (Blanchard 1921, USNM Bull. 114) and Rio Santa Maria (Smith and Taylor 1945, USNM Bull. 187:140). These additions extend the known range of *splendida* south to central Chihuahua.

Rhinocheilus lecontei tessellatus Garman.—Between September 6 and 10, 1959 three males (BYU 15343, 15286, 15318) and two females (BYU 15284, 15285) were taken: 17.1 mi. S of Sueco; 37.7, 33.3, 7.1, and 6.7 mi. N of Chihuahua City. All were DOR except BYU 15284, which was crossing the road at 8:15 p.m.

Their characteristics are summarized as follows: scale rows 23-23-19; ventral range, 195-203 in males, 186-190 in females; caudals 50-54 in males, 49-51 in females; supralabials 8-8; infralabials 9-9; preocular 1-1; postoculars 2-2; loreal 1-1; temporals 1-2 or 2-3; and anal single.

In all specimens the dark dorsal blotches are smaller than, or with only an occasional one equal to, the intervening light spaces. Thus, they appear lighter than *tessellatus* but are generally darker than *lecontei*. For the width of a few mid-dorsal scales each space between the blotches has a narrow bright red stripe. One specimen (BYU 15284) is a juvenile and has more distinct spots with an almost uniform light buff brown between the spots. On each side the spots become triangular with a narrow extention to the ventrals. Laterally the narrowed extentions alternate with similar dark bars which are separated dorsally by 5-6 dorsal scales.

Unfortunately the head is badly smashed in the larger specimens, making it impossible to use the rostral character. It is, therefore, not as yet clear whether the Chihuahua population is more closely related to *lecontei* or to *tessellatus*. We suspect the latter.

The finding of this genus in Chihuahua is not surprising since it occurs in Arizona, New Mexico, Texas and Coahuila.

Sonora semiannulata isozona Cope.—Ten representatives (BYU 14203, 14206, 15289-15292, 13852, 14246) were taken: two, 11.5 mi. SE of Nuevo Casas Grandes, August 21, 1957 and July 30, 1958; seven from a

*It is not certain whether the old or new Casa Grandes is the type locality. We suspect the old which is approximately five miles SW of the one commonly listed on modern maps.

hillside 1.5 mi. W of highway 45 at a point 6.5 mi. N of Chihuahua City, July 28, 1958 and September 5-9, 1959; and one from 37.7 mi. N of Chihuahua City, September 6, 1959.

Characteristics: scale rows 15-15-15 or 15-14-14; ventrals in males 149-153, females 160-168; caudals in males 53-54, females 45-51; supralabials 7-7 or 6-7; infralabials 6-6, 6-7 or 7-7; temporals 1-2; preocular and loreals each single; and anal divided. Tail length divided by distance from snout to vent: .260-.293 in males; .233-.257 in females. Color pattern is variable. Five specimens are bicolored with 28-35 black bars on dorsum of body and 8-12 on tail; one approaches a dark Olive Buff (Ridgeway, Plate XL) but has a dark center in each scale; two juveniles are similar but with dorsum of head black; another Flame Scarlet (*loc. cit.* Plate II), and still another Peach Red (*loc. cit.* Plate I). In none of the unicolored specimens is there the slightest indication of the barred bicolored or lined pattern.

Ficimia cana Cope.—A female (BYU 15257) was crossing the road, 5.5 mi. NE of Colonia Juarez at 10:00 p.m., approximately 2 hours after a light rain, September 3, 1959. The area has grassy foothills which are composed of much loose sand and gravel.

When seized, it reacted by jerking vigorously, causing a popping sound with its vent and defeciating with every contraction.

This find confirmed a suspicion formed in 1957 while talking with natives who claimed to have seen such a snake in the sandy areas after rains. It is commonly called the "cochinia" and is considered to be dangerous, as are most snakes in this area.

Characteristics observed: total length 310 mm., tail 44 mm.; dark-edged crossbars on body 38, on tail 11, some reaching ventrals; scale rows 17-17-17 all smooth; ventrals 138; caudals 30; supralabials 7-7; infralabials 7-8; preoculars 1-1; postoculars 2-2; loreal absent; temporals 1-2, and anal divided. Rostral separated from frontal by prefrontals; internasals reduced, separated by modified rostral; nasal with first supralabial; and prefrontals in contact with second supralabial.

Tantilla n. nigriceps Kennicott.—Three specimens have been taken: two at Colonia Juarez, July 1, 1958 and late September, 1959, and one at Chihuahua City, July 9, 1958. The latter is in poor condition. All three have the distinct V-shaped dark head cap which extends 3 or 4 scale rows onto nape. In one from Colonia Juarez, the supralabials on each side separate the postoculars from the temporal.

We have found *nigriceps* to occur in the lower desert areas, whereas *T. wilcoxi* inhabits the higher slopes ranging up to the lower edge of the Ponderosa Pine and Oak.

The occurrence of *nigriceps* in the Rio Conchos drainage suggests that it ranges much further south than Chihuahua City.

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Omission:—Vol. 15 (2):108,, line 5, *"T. dominicana"* should appear at the top of the column entitled "Species and Original Description" in table 2.

REMARKS CONCERNING BAHAMAN BLIND SNAKES (GENUS *TYPHLOPS*).—Since the publication of a recent paper dealing with Antillean *Typhlops* (Legler, 1959, Herpetologica, 15 (2): 105-112), I have had opportunity to examine nine additional specimens from the Bahamas. I am grateful to Dr. Ernest E. Williams, Museum of Camparative Zoology (MCZ) and to Dr. Yngve Löwegren, Director of the Zoological Museum, Lunds Universitet, Lund, Sweden (ZML) for permitting me to study specimens in their care.

Typhlops biminiensis Richmond 1955

Typhlops tenuis was included in the fauna of the Bahamas (Legler, *op. cit.*: 108-109) on the basis of a record by Rosén (1911, Lunds Univ. Årsskr., N.F., ser. 2, 7 (5):37) for Andros Island. The specimen referred to by Rosén (ZML, unnumbered) agrees in all important respects with the type description of *T. biminiensis* (Richmond, 1955, Am. Mus. Nov., 1734:203, fig. 1) and with a specimen of *T. biminiensis* from *Bimini* (MCZ 57431) before me. Richmond (*op. cit.*: 3-4) suggested that the ZML specimen was *biminiensis* but seemingly no American worker has examined the specimen until now. Data pertaining to the ZML and MCZ specimens, respectively, are as follows: scale-rows 22-22-22, 24-22-22; dorsal scales 472, 470; total vertebrae (determined by x-ray) 244, 235; total length (mm.) 259, 244; total length divided by diameter at mid-body 64, 54; preocular in contact with second and third supralabial; dorsum brownish, venter cream, the lateral division between the two colors obscure on anterior part of body but becoming progressively more distinct posteriorly, posteriormost part of body and tail sharply bicolored, the pale color encroaching irregularly on the dark and creating a jagged line, especially above vent. In both specimens the head, in profile, is more flattened and the snout more attenuate than in the specimen illustrated by Richmond (*op. cit.*; fig. 1).

Typhlops lumbricalis (Linnaeus)

Six specimens from various localities in the Bahamas are at hand. Data on scalation and bodily proportions are as follows: scale-rows 20-20-18 (2 specimens), 20-19-18 (2), 20-18-18 (2); dorsal scales 244-273 (average 263); total vertebrae 162-174; total length 111-176 mm.; total length divided by diameter at midbody 20 to 38 (average 35). The specimens differ in no important respect from Cuban material I have examined.

Typhlops silus Legler

A single specimen (MCZ 42343) of this recently described species (Legler, *op. cit.*), from Water Cay, Grand Bahama, is before me. The specimen constitutes the first known record of *silus* in the Bahamas and increases to three the number of species known to occur there. It corresponds in general with the type and paratypes. Data pertaining to the specimens are: scale-rows 20-20-18; dorsal scales 256; total vertebrae 175; total length 106 mm.; total length divided by diameter at mid-body 34; internasal suture incomplete on both sides.

Specimens examined (total of nine from Bahamas).—*T. biminiensis*: ZML (unnumbered), Stanniard Creek, Andros; MCZ 57431, Lerner Marine Laboratory, Bimini; *T. lumbricalis*: MCZ 6970, Abaco; ZML (unnumbered), Mastic Point, Andros; MCZ 44335, Water Cay, Grand Bahama; MCZ 42270, Clarence Town, Long Island; ZML (unnumbered) and MCZ 8770, Nassau, New Providence; *T. silus*: MCZ 42343, Water Cay, Grand Bahama.

Remarks.—I am obliged to note the careless omission, in my earlier paper (Legler, *op. cit*) of two species of Antillean blind snakes. *T. biminiensis* Richmond and *T. caymanensis* Sackett. These two species may be easily included in the key (Legler *op. cit.*: 110-111) by substituting the following for couplets 5 and 6:

5. Scale-rows 18, reduced to 16 posteriorly—Caja de Muertos *T. granti*
   Scale-rows 20 6
6. Preocular in contact with second and third supralabials; scale-rows 20-20-20—Grand Cayman Island ..... *T. caymanensis*
   Preocular in contact only with third supralabial..... 7

The following should be inserted between couplets 1 and 2 (the first half of couplet 1 should then lead to 1a):

1a Preocular in contact with second and third supralabials; scale-rows (24-22)-(24-22)-(22)—Bahamas..... *T. biminiensis*
   Preocular in contact only with third supralabial..... 2

—*John M. Legler, Department of Zoology, University of Utah, Salt Lake City.*

EGGS AND YOUNG OF SEVERAL TEXAS REPTILES.—During the spring and summer of 1959 observations were made on certain Texas reptiles, for the most part by the writer, with two contributions from Thomas Wright. Donald Meineke, Thomas Wright and Richard Worthington assisted in the field. All measurements are recorded in millimeters and were made soon after the laying or hatching of eggs or birth of young; t-l indicates total length, s-v, snout-vent length and c-l carapace length.

Uta stanburiana stejnegeri (Schmidt).—A female, 48 s-v, from Kermit, Winkler Co., laid four eggs June 11, Egg length-width: 11-7, 12-7, 13-7, 13-7, av. 12.3-7. On June 16, a 52 s-v female from Kermit, Winkler Co. was found to contain five eggs, apparently ready to be laid. Egg length-width: 9-7, 11-6, 11-7, 11-7, 12-7 av. 10.7-6.7.

Diadophis punctatus arnyi (Kennicott).—A DOR female, 295 t-l, found June 7 near Harper, Gillespie Co., contained four large eggs.

Heterodon nasicus gloydi (Edgren).—On July 17, a 552 t-l (68-tail) female from Galveston Island, Galveston Co. laid five eggs; two of these adhered. Egg length-width: 30-19, 32-20, 33-20, 34-19, 34-20, av. 32.6-19.6. One egg hatched September 10, 165 t-l (21 tail). The young snake's pattern resembled that of the adult except that the belly lacked the golden color between the black. It was not until after the second shedding that this color began to appear.

Gophorus berlandieri (Agassiz).—On June 22, a 141 t-l specimen from Three Points, Webb Co., laid a single egg. She dug a hole 1¾" in diameter by 3" in depth for the egg. Egg length-width: 46-32.

Kinosternon subrubrum hippocrepis (Grey).—On June 21 a 80 t-l female from Hockley, Harris Co. laid a single brittle shelled egg, length-width: 29-16. On September 28 the egg hatched. The hatchling's carapace and skin is a dirty brown except for two faint yellow lines on the neck and side of head and on the underside of each marginal there is a round light orange spot. The plastron has ten paired irregular orange spots, on a ground color of black.—*Michael Sabath, 3212 West Dallas Avenue, Houston, Texas.*